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NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

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NAVAL SEA SYSTEM COMMAND

FRICTIONAL HOLD OF VARIOUS SHEAVE CONFIGURATIONS ON SYNTHETIC ROPES

February 1984

BATTELLE
Columbus Laboratories
505 King Avenue
Columbus, OH 43201

N62583/83-M-R054

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METRIC CONVERSION FACTORS

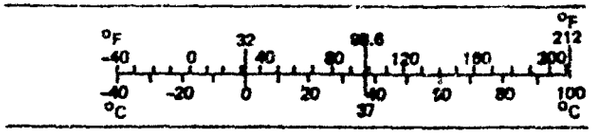
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6 5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0 8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0 4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0 45	kilograms	kg
	short tons (2,000 lb)	0 9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0 24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3 8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0 76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0 4	inches	in
m	meters	3 3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0 6	miles	mi
		AREA		
cm^2	square centimeters	0 16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0 4	square miles	mi^2
ha	hectares (10,000 m^2)	2 5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1,000 kg)	1 1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2 1	pints	pt
l	liters	1 06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thirty eight test series were conducted using eleven different sheave configurations, two sizes of polyester rope, and one size of nylon rope. Tests were conducted with a taut line wrapped around a rotating sheave in both wet and dry conditions. Friction coefficients were measured continuously from static to slipping condition. The test variables include line

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tension, sheave diameter, line diameter, groove geometry, groove surface roughness, groove coating material and speed of sheave rotation. The coefficient of friction was found to decrease with decreasing groove surface roughness, decreasing sheave diameter, increasing enclosed angle of the groove and increasing line tension. The rougher surfaces rapidly destroyed the line and are not recommended for use with traction winches. The frictional hold decreased as the line was wearing against the sheave surface. For traction winch design, a V-groove steel sheave with a smooth surface is recommended for polyester 2-in-1 braid. The nylon lines have approximately 10% greater frictional hold than polyester lines.

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SUMMARY REPORT

on

FRICTIONAL HOLD OF VARIOUS SHEAVE CONFIGURATIONS ON SYNTHETIC ROPES

to

NAVAL CIVIL ENGINEERING LABORATORY
PORT HUENEME, CA 93043

November 1983

INTRODUCTION

This report summarizes the results of an experimental program conducted for the Naval Civil Engineering Laboratory under contract no. N62583/83 M T291 to provide data for the design of traction winch sheaves. An earlier report titled "Frictional Hold Versus Sheave Groove Shape and Diameter for Polyester Rope", under NCEL contract no. N668305-3003-3641, has been combined with this report. The objective of these two programs was to determine the effect of sheave groove shape, sheave groove surface roughness or coating, sheave diameter, and line tension on the frictional hold of 2-in-1 nylon and polyester rope.

Thirty eight test series were conducted using 11 different sheave configurations, two sizes of polyester rope, and one size of nylon rope. Tests were conducted under both wet and dry rope conditions. Five sheaves and two of the ropes were supplied by NCEL. Battelle provided one of the polyester ropes, the testing facilities and made various modifications to the NCEL supplied sheaves to create 6 more sheave configurations. The frictional hold capability was determined from the difference in rope tension on opposite sides of a rotating sheave.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions have been drawn from the test results:

(1) The coefficient of friction between polyester or nylon rope and any sheave decreases with increase in tension on the rope.

(2) For a given rope tension, the frictional hold capability of a sheave increases with diameter (either rope or sheave) due to the reduction of rope pressure on the sheave.

(3) The frictional hold of a sheave increases with a decrease in the included angle of sheave groove.

(4) The frictional hold of a sheave decreases as rope wear increases.

(5) Urethane coating has the highest coefficient of friction of any of the surfaces tested, but this coating is not suitable for tensions above 20,000 pounds due to separation of the coating from the sheave and embedding in the rope.

(6) The test using the 14 inch pitch diameter 45-V groove sheave did not represent a true 45-V sheave because, the root radius at the bottom of the groove was machined too large and could not be adjusted.

(7) Decreasing the sheave rotation rate on the test stand from the 10 rpm used in the first 10 tests to 1 rpm, effectively lowered the creep rate of the rope on the sheave, thus achieving a more realistic creep rate. This resulted in an increased frictional hold of the sheave.

(8) At the 10 rpm rotational sheave rate using new rope, the "static" coefficient of friction (as defined in this report) was between 23% to 56% higher than the sliding coefficient of friction. At the 1 rpm sheave rate, the range of percentages was from 0 to 11%.

(9) Considering rope wear and frictional hold at 55,000 pounds, among the sheaves tested a smooth steel sheave was determined to be the most effective surface for polyester rope.

(10) On the average, nylon rope had about 10 percent better frictional hold than polyester rope.

(11) Considering wear and frictional hold at all loads, among those surfaces tested the best surface for nylon rope was found to be nylon, with smooth steel as a reasonable second choice.

(12) For a traction winch using polyester rope and pulling a load of 55,000 pounds at 35 feet per minute, the relative velocity of creep or slippage between the rope and the sheave surface due to stretching of the rope under load would be about .4 inch per second on the sheave with the highest rope tension.

This study has yielded numerical information that allows the traction winch designer to calculate, with a degree of confidence, the back tension required for traction winch designs that use varying sheave shapes, sheave diameters, and sheave quantities. However, there is no known data concerning the capability of back-tensioning devices. Therefore, we recommend that an experimental program be conducted to develop design data for typical back-tensioning devices.

TEST SETUP

The test setup consists, basically, of wrapping a synthetic rope 180 degrees around a driven sheave, with one end of the rope secured and the other end attached to a pulling cylinder. Load cells are used to measure the tension in the rope on each side of the sheave. Figure 1* is a schematic of the test setup. Figure 2 shows a photograph of

*Note: All figures and tables for this report have been collected together the end of the report, prior to the Appendices.

the test facilities. The maximum allowable load on the upper high tension leg of the test setup is 55,000 pounds. The rotation of the sheave is toward the pulling cylinder.

The synthetic rope is held at each end by Battelle developed synthetic line stoppers. These stoppers are for holding onto a synthetic rope, up to a predetermined load, without requiring any eyes or splicing of the rope. The stopper consists of two smooth plates facing each other. The front and back edges of the plates are radiused to prevent cutting into the synthetic rope. The two plates are caused to squeeze the rope with enough force to hold the rope up to the maximum load desired. Since the plates are smooth, the rope can slip without damage when the load exceeds the frictional hold of the stopper, thus reducing the chances of breaking the rope. Figure 3 shows a photograph of the synthetic line stopper.

The pulling cylinder has a 6-inch diameter bore with a 4-inch diameter rod. The maximum operating pressure of 3000 psi gives a pulling force of 45,000 pounds. The stroke of the cylinder is 19 inches.

The sheave drive is a SM-CYCLO DRIVE model HJ639Y gear reducer with a 7 hp motor and a 1711 to 1 reduction ratio. It can provide up to 392,000 inch pounds of torque at a rotational rate of 1 rpm.

Table 1 gives the specifications and calibration dates for the instrumentation used in the conduct of the tests.

When conducting the wet rope tests, the rope was first presoaked for several minutes in a tank of water. Then, with the rope on the sheave, a continuous spray of water was directed downward on the high tension side of the sheave allowing the water to flow around the sheave (see Figure 4).

TEST PROCEDURE

The following steps describe the procedure used to determine the frictional hold that a sheave has on synthetic rope:

(1) At the start of each test series, the strip chart recorder is set for a full-scale load of 50,000 pounds. The calibration is noted on the chart paper and dated.

(2) The selected sheave is placed on the sheave drive shaft.

(3) The synthetic rope is threaded through the lower clamp, around the sheave, and through the upper clamp. If the test is to be run wet, the segment of rope that passes around the sheave is presoaked.

(4) The lower clamp is then tightened until the squeeze on the rope is enough to achieve the desired maximum load.

(5) The rod of the pulling cylinder is fully extended.

(6) All slack is removed from the rope, and the upper clamp is tightened until the squeeze on the rope is enough to achieve the desired maximum load.

(7) The pulling cylinder pressure is increased until the lower load cell reads about 20,000 pounds.

(8) With the recorder on, the sheave drive motor is turned on.

(9) After about twenty seconds, with the sheave still rotating, the load is decreased to between 3,000 and 5,000 pounds.

(10) The frictional hold over a range of loads is determined by slowly increasing the load until the maximum desired load is achieved on the high side, and then slowly decreasing the load.

(11) Step 10 is then repeated.

RESULTS

Thirty eight test series were conducted using 11 different sheave configurations, two sizes of polyester rope, one size of nylon

rope, and under wet or dry conditions. Table 2 provides the characteristics of each of the sheave configurations tested. As can be seen in Table 2, six basic groove shapes were tested and the 70^0 "V" groove and the "U" groove received multiple surface treatments on the grooves. Table 3 is a summary of all tests, and shows the parameters that were varied. Photographs are provided in Appendix B of test specimens 11 through 38 showing rope wear and contamination. Figure 5 shows the recorded data of a typical test run. This chart shows the rope tension on each side of the sheave. Reduced copies of all the strip chart recordings are in Appendix A. The sheave rotational speed for the first 10 tests was 10 rpm (revolutions per minute), and for the last twenty-eight tests the sheave rotational speed was 1 RPM.

The relationship of belt (rope) friction to tension on a sheave can be defined as follows (Ref. 1):

$$T_h = T_1 * \exp(\mu * a) \qquad \text{(Equation 1)}$$

where: T_h = high tension, or pulling tension
T_1 = low tension, or back tension
μ = coefficient of friction between rope and sheave
a = angle in radians enclosed by the two ends of the rope.

by rearranging equation (1), the "effective" coefficient of friction (μ), for various sheave configurations, can be calculated from the rope tension data using the following formula for a 180-degree wrap:

$$\mu = (\mathrm{Ln}(Th/T1))/\pi \qquad \text{(Equation 2)}$$

The change in "effective" coefficient of friction as a function of rope tension was determined from both the increasing and decreasing load portion of the test (see Figure 5). In Figure 6, the effect of increasing and decreasing the load through two cycles, on the friction of the 45-degree V-groove sheave is shown. This effect is typical of the other

tests, although the results are somewhat scattered. However, Figure 6 does confirm that the frictional hold of the sheave is affected by whether the load is increasing or decreasing.

DISCUSSION

Prior to initiation of this test program there was considerable controversy over whether a synthetic rope wrapped on a traction winch sheave would exhibit a considerably higher "static" or "breakaway" load versus the dynamic or fully "sliding" load for a given low side tension. The reason for the controversy is that for a fixed sheave, as the high side tension increases, the synthetic rope must stretch and "creep" around the entire contact area of the sheave until the increasing load reaches the low side point of contact. Thus, depending upon the rate at which the high side load increases, the rope may actually be sliding with respect to the sheave surface for nearly the entire arc of contact before the high side tension reaches its so-called static breakaway load. This breakaway effect was simulated in the testing by placing a known low side tension on the rope, allowing the sheave to freely rotate until the high and low side tensions evened out, and then starting the sheave to rotate. Although this does not exactly simulate the state of stretch of the rope around a traction winch, it is felt that the condition is indicative of the difference between the static and dynamic coefficients of friction to be expected from a traction winch.

The "effective" static coefficient of friction was selected to be the maximum ratio of high and low side tensions that occurred within a few seconds after starting the sheave rotating (see Figure 5). The related sliding coefficient of friction was selected from the ratio of tensions about 20 seconds after the static friction. Table 4 lists the ratios of static coefficient of friction to sliding coefficient of friction. For the first ten tests (10 rpm sheave rate) the new rope ratio varied from 1.23 to 1.56 with the average being 1.35. For the last twenty eight tests (1 rpm sheave rate) the new rope ratio varied

from 1.005 to 1.11 with the average being 1.05. After the rope has been subjected to a minute or more of slippage under load, the coefficient of friction ratio varied from 1.03 to 1.16. Thus, it appears reasonable to use only the dynamic coefficients of friction for winch design purposes.

After completing the regular test procedure for test 12, which was wet polyester rope on the 70-V smooth steel sheave, the low tension leg was loaded to 15,000 pounds and the sheave was rotated for one hour. As anticipated, the "effective" coefficient of friction did decrease from .22 at the beginning of the test down to .17 after running one hour and with considerably more rope wear.

It is fairly well known that the dynamic coefficient of friction between plastics and steel decreases as the contact pressure between the plastic material and the steel increases. A review of the test data also suggested that, for a given sheave-groove shape, the "effective" coefficient of friction is a function of the rope pressure against the sheave. In order to investigate this theory, an effective rope pressure was defined as the total load on the sheave divided by the product of sheave-pitch diameter and rope diameter:

$$P = (T_h + T_l)/(D_p * D_r) \qquad \text{(Equation 3)}$$

where: P = rope pressure
D_p - sheave pitch diameter
D_r = rope diameter.

Note that "rope pressure" is not the actual contact pressure between the rope and the sheave. The contact pressure will vary, depending on the location along the sheave and the shape of the sheave groove. As an example, the rope wear resulting from test number 23 clearly shows an increase in the contact area as the rope goes toward the high tension side. The width of rope not contacting the bottom of the sheave varied from 1-¼ inch at the low tension side, to zero at a point measured 22 inches around the circumference of the sheave. This effect can be seen in Figure 7 and in the photographs in Appendix B.

Figures 8 and 9 give an example of the effect of "rope pressure", calculated using Equation (3), on the frictional hold of a sheave on polyester rope at a 10 rpm sheave rotational rate. Figure 10 (Ref. 2) shows the effect bearing load has on the coefficient of friction of plastic bearings. This information, along with references (3 and 4), and discussions with Battelle's tribology research staff, substantiate that the coefficient of friction decreases with an increase in pressure for plastics. This was also confirmed during sheave testing.

The curves shown in Figures 8 and 9, and in later figures, have least square exponential curve fit shown for each set of test data. The least square fit of linear, power, exponential, and logarithmic curves were determined for each set of test data. Table 5 shows the least square correlation coefficient for each test. For the range of "rope pressure" tested, three of the curve types have nearly equal average correlation coefficients. Exponential curves were selected for plotting, since they provide the best fit, especially for the coefficients of friction at low contact pressures. Table 6 lists the constants for exponential curves.

Figures 11 through 14 show the effect of groove shape on nylon and polyester ropes for both dry and wet conditions. As can be seen in these figures, the coefficient of friction increases as the included angle of the sheave groove decreases. This is consistent with the frictional hold of V-pulleys on V-Belt which can be defined as follows (Ref. 1):

$$T_h = T_1 \exp\left(\mu a / \sin(\alpha/2)\right) \qquad \text{(Equation 4)}$$

where α is the included angle of the sheave.

The 45^{o}-V (Test #10) is not shown in these figures since the root radius of this sheave was not made to specification. The large root radius of the sheave supplied makes it essentially a U-groove type of sheave.

Figures 11 through 14 also show that wet ropes tend to exhibit higher coefficients of friction than dry ropes on steel sheaves. This is also consistent with experience with plastic seals, some of which exhibit more sliding friction when wet than when dry while running against steel surfaces.

Figures 15 and 16 show the effect of the groove surface condition or coating on dry and wet polyester rope. Even though the urethane coating provides a higher frictional hold, a smooth steel sheave is the most effective surface for polyester rope. A rough steel surface temporarily has higher frictional hold, but it causes more rapid rope wear which results in a decrease in frictional hold. Figure 17 illustrates the difference in wear resulting from smooth and rough sheaves. The abrading of rope on a rough surface, forms a layer of rope fibers on the sheave surface which, in turn, contributes to a reduction in frictional hold (see Figure 18).

The frictional hold of the urethane coating is too good, especially at light loads (see data for test run numbers 33 and 34 in Appendix C). At the start of test 33 and with a preload of about 2000 pounds, the high tension leg rapidly climbed to 20,000 pounds before loudly releasing and dropping back to about 2500 pounds. (This can be seen in the strip chart for test number 33 in Appendix A). After completion of test 33, the rope adhered to the coating and had to be pried off the sheave. It is believed that the loud report heard was caused by the snap back when the rope broke the adhesion of the urethane coating from the sheave. Figure 19 shows the urethane embedded in the rope and Figure 20 shows the wear on the sheave. The whitish band, at the lower left of the photo in Figure 20, is bare metal on the sheave surface. Even in this worn condition, the frictional hold of the sheave on the rope was still high for the wet rope test, and additional urethane did embed into the rope.

Figures 21 and 22 illustrate the effect of groove surface or coatings on dry and wet nylon rope. Figure 23 illustrates the difference in wear resulting from smooth and rough sheaves. Based on the

test results, for minimum wear when using nylon rope, the best sheave surface appears to be nylon, with smooth steel a reasonable second choice.

Table 7 shows a comparison of polyester rope to nylon rope performance for equivalent pairs. On the average, nylon rope had about 10 percent better frictional hold than polyester rope.

As discussed in the beginning of this section, a rope creeps on the sheave as the rope moves from the low load to the high load side of the sheave. The creep occurs because the rope must go from a lower state of stretch to a higher state of stretch as the load increases. Thus, when a moving rope starts its wrap around a rotating sheave, it is moving at a specific speed. The frictional hold the sheave has on the rope stretches the rope as it goes around the sheave; thus, the rope exits at a different velocity. This exit velocity (V_h) for a 180-degree wrap can be defined as:

$$V_h = V_1 \left[1 + \frac{T_1(e^{\mu\pi}-1)}{EA} \right] \qquad \text{(Equation 5)}$$

where: V_1 = rope velocity at low tension side
E = elastic modulus of the rope
A = cross-sectional area of the rope.

The derivative of equation (5) is shown in Appendix D.

If the sheave is rotating at the same speed as the entrance velocity, the difference between the two velocities defines the relative velocity of slip of the rope on the sheave. Applying Equation (5) to a winch that is assumed to have eight 70-degree V sheaves and to be pulling a load of 55,000 pounds with 3.62 inch diameter, 2-in-1 polyester rope that is moving at a velocity of 35 feet per minute, the relative velocity of slip of the rope on the highest loaded sheave surface is about .4 inch per second (see Appendix D for calculations).

In the original test setup, the sheave was rotated at 10 rpm, which translates into a relative slip velocity of 12.0 inch per second. When the test equipment was modified to reduce the sheave rotational

rate to 1 rpm, the result was a relative slip velocity of 1.2 inches per second. At this lower speed, it is possible to realistically evaluate a winch operating in the 90 feet per minute range. The reduction in speed also improved the frictional hold on the rope, as can be seen in Figure 24. The improvement is most dramatic for the 70-degree V sheave.

At the same time that the computer program, listed in Appendix D, calculates relative velocity, it also calculates required back tension for various pulling tensions. Figure 25 shows the estimated back tension as a function of pulling tension for a number of traction winch configurations. This winch is assumed to be using 3.62-inch diameter 2-in-1 polyester rope. The coefficient of friction estimates are taken from test #13 for a 3.5-U sheave, test #11 for a 70-V sheave, and test #35 for 50^{o}-V sheave. Three sizes (pitch diameters) of sheaves are used - 14, 24, and 36 inches. The rope elongation and coefficient of friction was estimated for each sheave. The curves are listed in order of decreasing required back tension. Based on these curves, the most suitable sheave combination appears to be the 50^{o}-V, 8 sheave arrangement with a pitch diameter of 24 inches. Selecting the 10 sheave or 36 inch diameter would be an unnecessary expense if a suitable method of providing back tensioning is available.

The curves in Figure 25 are considerably less than the curves shown in Figure 6 of Reference 5. For the 70-V, 10 sheaves, 18.38 tread diameter winch, the back tension for pulling 100,000 pounds dropped from the 2778 pounds derived at during the initial tests at 10 rpm, to 154 pounds.

REFERENCES

(1) Beer, F. P. and Johnston, Jr., E.R., "Vector Mechanics for Engineers", McGraw-Hill, 1962, pp 305-306.

(2) "Fiberglide - Self-Lubricating Bearing Catalog", Rev. A1074, Lear Siegler, Inc., page 7.

(3) Bowden, F. P. and D. Tabor, "The Friction and Lubrication of Solids - Part II", Oxford Press, 1964, p 227.

(4) "Kamatics Bearing Systems", Kamatics Corporation, 1983, p 19.

(5) Albro, C. S., and L. F. Nikodem, "Frictional Hold Versus Sheave Groove Shape and Diameter for Polyester Rope", Battelle, June 1983, pp 1-17.

TABLE 1. TEST INSTRUMENTS

Instrument	Make and Model	Serial No.	Battelle No.	Calibration Date
Upper Load Cell Range 0-50 Kips	Dillon SCMT 50K	T2407	--	2-22-83
Stain Gage Conditioner	Daytronic 3270	--	LN-532297	2-26-83
Lower Load Cell Range ± 50 Kips	Interface 1220-A1	16979	--	2-22-83
Stain Gage Conditioner	Daytronic 3270	--	LN-532204	2-3-82
Strip Recorder	Honeywell Electronik 195	--	LN-161403	3-11-83
Decade Resistor	General Radio Co. 1434-G	4359	LN-489160	10-29-82

TABLE 2. SHEAVES TESTED

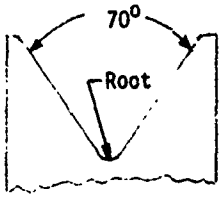
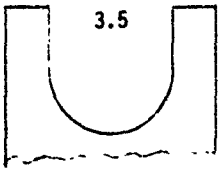
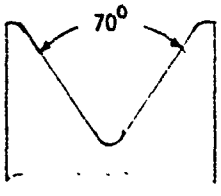
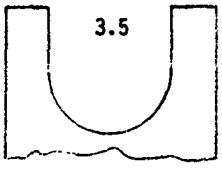
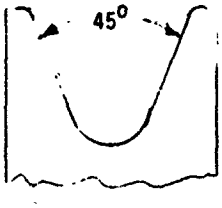
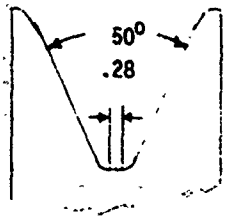
	Basic Shape	Tread Diameter Inches	Root Radius Inches	Surface Finish or Coating
	70-V	18.44	.38	Smooth (64 RMS) Rough (600 GRIT) KF Polymer (600 GRIT) Nylon Urethane
	3.5-U	20.39	1.75	Smooth (64 RMS) KF Polymer (600 GRIT)
	70-V	9.30	.38	Smooth (64 RMS)
	3.5-U	11.32	1.75	Smooth (125 RMS)
	45-V	8.99	1.12	Smooth (125 RMS)
	50-V	16.30	.38	Smooth (64 RMS)

TABLE 3. SUMMARY OF TESTS

RUN NO.	SHEAVE SHAPE	SHEAVE DIA. (IN)	ROPE TYPE	ROPE DIA. (IN)	ROPE COND.	RELATIVE VELOCITY (IN/SEC)	AVERAGE COEFFICIENT OF FRICTION (25 KIPS)	AVERAGE COEFFICIENT OF FRICTION (50 KIPS)
1	70-V SMOOTH STEEL	24.0	POLYESTER	3.62	WET	12.6	0.13	0.10
2	3.5-U SMOOTH STEEL	24.0	POLYESTER	3.62	WET	12.6	0.11	0.09
3	3.5-U SMOOTH STEEL	24.0	POLYESTER	3.62	DRY	12.6	0.12	0.09
4	70-V SMOOTH STEEL	14.0	POLYESTER	3.62	DRY	7.3	0.12	0.08
5	70-V SMOOTH STEEL	14.0	POLYESTER	3.62	WET	7.3	0.12	0.07
6	70-V SMOOTH STEEL	11.4	POLYESTER	2.00	DRY	6.0	0.10	----
7	3.5-U SMOOTH STEEL	13.3	POLYESTER	2.00	DRY	7.0	0.05	----
8	3.5-U SMOOTH STEEL	15.0	POLYESTER	3.62	DRY	7.9	0.10	0.07
9	3.5-U SMOOTH STEEL	15.0	POLYESTER	3.62	WET	7.9	0.10	0.08
10	45-V SMOOTH STEEL	14.0	POLYESTER	3.62	DRY	7.3	0.12	0.08
11	70-V SMOOTH STEEL	24.0	POLYESTER	3.62	DRY	1.3	0.20	0.16
12	70-V SMOOTH STEEL	24.0	POLYESTER	3.62	WET	1.3	0.26	0.22
13	3.5-U SMOOTH STEEL	24.0	POLYESTER	3.62	DRY	1.3	0.13	0.10
14	3.5-U SMOOTH STEEL	24.0	POLYESTER	3.62	WET	1.3	0.15	0.12
15	3.5-U SMOOTH STEEL	23.0	NYLON	2.62	DRY	1.2	0.11	----
16	3.5-U SMOOTH STEEL	23.0	NYLON	2.62	WET	1.2	0.13	----
17	70-V SMOOTH STEEL	22.5	NYLON	2.62	DRY	1.2	0.20	----
18	70-V SMOOTH STEEL	22.5	NYLON	2.62	WET	1.2	0.20	----
19	70-V ROUGH STEEL	22.5	NYLON	2.62	DRY	1.2	0.18	----
20	70-V ROUGH STEEL	22.5	NYLON	2.62	WET	1.2	0.25	----
21	70-V ROUGH STEEL	24.0	PLOYESTER	3.62	DRY	1.3	0.16	0.14
22	70-V ROUGH STEEL	24.0	POLYESTER	3.62	WET	1.3	0.19	0.16
23	70-V KF POLYMER	24.0	POLYESTER	3.62	DRY	1.3	0.20	0.17
24	70-V KF POLYMER	24.0	POLYESTER	3.62	WET	1.3	0.25	0.22
25	3.5-U KF POLYMER	24.0	POLYESTER	3.62	DRY	1.3	0.15	0.12
26	3.5-U KF POLYMER	24.0	POLYESTER	3.62	WET	1.3	0.19	0.13
27	70-V KF POLYMER	22.5	NYLON	2.62	DRY	1.2	0.22	----
28	70-V KF POLYMER	22.5	NYLON	2.62	WET	1.2	0.22	----
29	70-V NYLON	22.5	NYLON	2.62	DRY	1.2	0.20	----
30	70-V NYLON	22.5	NYLON	2.62	WET	1.2	0.19	----
31	70-V NYLON	24.0	POLYESTER	3.62	DRY	1.3	0.14	----
32	70-V NYLON	24.0	POLYESTER	3.62	WET	1.3	0.14	0.12
33	70-V URETHANE	24.1	POLYESTER	3.62	DRY	1.3	0.38	0.27
34	70-V URETHANE-WORN	24.1	POLYESTER	3.62	WET	1.3	0.41	0.19
35	50-V SMOOTH STEEL	23.2	POLYESTER	3.62	DRY	1.2	0.25	0.19
36	50-V SMOOTH STEEL	23.2	POLYESTER	3.62	WET	1.2	0.27	0.21
37	50-V SMOOTH STEEL	20.9	NYLON	2.62	DRY	1.1	0.22	----
38	50-V SMOOTH STEEL	20.9	NYLON	2.62	WET	1.1	0.28	----

TABLE 4. STATIC/SLIDING FRICTIONAL RATIO

Test no.	Rope Condition	Basic shape	Test type	High load Kips	Low load Kips	Coefficient of Friction	Static/Sliding Ratio
1	new	70-V	static	27.0	14.6	.196	1.44
			dynamic	22.2	14.5	.136	
1	used*	70-V	static	42.9	27.9	.137	1.16
			dynamic	40.6	28.0	.118	
4	new	70-V	static	42.5	26.0	.156	1.23
			dynamic	39.0	26.2	.127	
5	new	70-V	static	37.5	24.5	.135	1.26
			dynamic	35.0	25.0	.107	
5	used*	70-V	static	33.8	23.1	.121	1.03
			dynamic	33.5	23.2	.117	
8	new	70-V	static	43.3	27.7	.142	1.38
			dynamic	38.7	28.0	.103	
9	new	U	static	34.5	24.5	.109	1.24
			dynamic	32.3	24.5	.088	
10	new	45-V	static	35.2	18.2	.210	1.56
			dynamic	29.8	19.5	.135	
11	new	70-V	static	20.2	10.7	.202	1.005
			dynamic	20.5	10.9	.201	
12	used	70-V	static	30.0	15.2	.216	1.13
			dynamic	27.8	15.2	.192	
13	new	U	static	20.2	12.2	.161	1.09
			dynamic	19.1	12.0	.148	
14	new	U	static	23.9	18.9	.170	1.11
			dynamic	13.9	18.2	.148	
14	used	U	static	22.0	12.8	.172	1.10
			dynamic	20.5	12.5	.157	
15	new	U	static	12.7	8.8	.117	1.02
			dynamic	12.9	9.0	.115	
32	new	70-V	static	19.7	11.7	.166	1.08
			dynamic	19.0	11.7	.154	
35	new	50-V	static	28.3	12.9	.250	1.04
			dynamic	27.5	12.9	.241	
36	new	50-V	static	29.5	12.8	.266	1.02
			dynamic	28.5	12.5	.262	
37	new	50-V	static	19.5	8.7	.257	1.07
			dynamic	18.5	8.7	.240	
38	new	50-V	static	21.5	9.0	.277	1.01
			dynamic	21.0	8.9	.273	

*Used rope is defined to be rope that has experienced slippage on a sheave

TABLE 5. LEAST SQUARE CORRELATION COEFFICIENT

TEST	LIN	POW	EXP	LOG
1	.7443	.8710	.8324	.8235
2	.7925	.9646	.8769	.9223
3	.9516	.9811	.9756	.9777
4	.8631	.8405	.8775	.8527
5	.9004	.9130	.9268	.9310
6	.9212	.8951	.9348	.8936
7	.5040	.4763	.4774	.5083
8	.7923	.8628	.8180	.8722
9	.6996	.7295	.6714	.7762
10	.6644	.6969	.7166	.6593
11	.9407	.9674	.9525	.9714
12	.5435	.5413	.5073	.5648
13	.8792	.9273	.9032	.9284
14	.8247	.8555	.8531	.8489
15	.8011	.8439	.8179	.8439
16	.8478	.8767	.8533	.8841
17	.8936	.8750	.8914	.8882
18	.7942	.7775	.7808	.8016
19	.5664	.6107	.6056	.5929
20	.7412	.6405	.7522	.6360
21	.5440	.6248	.5933	.5889
22	.6748	.6744	.7465	.6082
23	.6775	.7421	.7325	.7030
24	.9059	.8798	.9089	.8825
25	.6278	.4484	.6334	.4464
26	.9490	.9533	.9620	.9635
27	.5826	.4919	.5230	.5471
28	.6395	.5738	.6205	.6013
29	.7764	.9004	.7967	.8964
30	.8949	.9694	.9252	.9629
31	.9640	.9782	.9790	.9881
32	.7954	.7972	.7961	.8050
33	.8417	.8847	.9047	.8960
34	.9199	.9411	.9649	.9547
35	.7552	.6672	.7672	.6680
36	.9305	.9368	.9397	.9422
37	.8965	.8984	.9034	.9008
38	.9466	.9655	.9580	.9627
AVG.	.7892	.8019	.8074	.8025

TABLE 6. CONSTANTS FOR EXPONENTIAL CURVE FIT

TEST	C1	C2
1	.2030	-7.477E-04
2	.1620	-7.219E-04
3	.1743	-7.354E-04
4	.1704	-4.238E-04
5	.2072	-6.366E-04
6	.1962	-3.515E-04
7	.0794	-1.972E-04
8	.1693	-5.372E-04
9	.1532	-4.873E-04
10	.1657	-3.908E-04
11	.2528	-4.878E-04
12	.2671	-3.015E-04
13	.1857	-6.236E-04
14	.1968	-5.080E-04
15	.1656	-5.993E-04
16	.1854	-5.531E-04
17	.2722	-4.408E-04
18	.2594	-4.917E-04
19	.2904	-6.389E-04
20	.3350	-4.334E-04
21	.2327	-6.382E-04
22	.2413	-4.604E-04
23	.2520	-5.037E-04
24	.2934	-3.928E-04
25	.1666	-2.377E-04
26	.2764	-7.655E-04
27	.2850	-4.399E-04
28	.2721	-4.050E-04
29	.3081	-6.109E-04
30	.3589	-9.935E-04
31	.2017	-6.838E-04
32	.1710	-3.358E-04
33	.7646	-1.809E-03
34	.8011	-1.745E-03
35	.3030	-4.360E-04
36	.3445	-5.119E-04
37	.3003	-4.709E-04
38	.4353	-6.798E-04

EQUATION FORM IS MU=C1*EXP(C2*PRESSURE)

TABLE 7. COMPARISON OF POLYESTER TO NYLON

TEST	PAIRS	SHEAVE	COEFFICIENT OF FRICTION* POLYESTER	NYLON	RATIO POLYESTER/NYLON
		DRY ROPE PAIRS			
11	17	70-V SMOOTH STEEL	.189	.209	0.903
13	15	3.5-U SMOOTH STEEL	.128	.116	1.105
21	19	70-V ROUGH STEEL	.159	.198	0.802
23	27	70-V KF POLYMER	.186	.219	0.851
31	29	70-V NYLON	.134	.214	0.627
35	37	50-V SMOOTH STEEL	.233	.226	1.030
		WET ROPE PAIRS			
12	18	70-V SMOOTH STEEL	.223	.193	1.154
14	16	3.5-U SMOOTH STEEL	.145	.133	1.091
22	20	70-V ROUGH STEEL	.183	.258	0.709
24	28	70-V KF POLYMER	.232	.213	1.086
32	30	70-V NYLON	.140	.198	0.707
36	38	50-V SMOOTH STEEL	.253	.290	0.875

*EXPONENTIAL CALCUATION AT 600 PSI

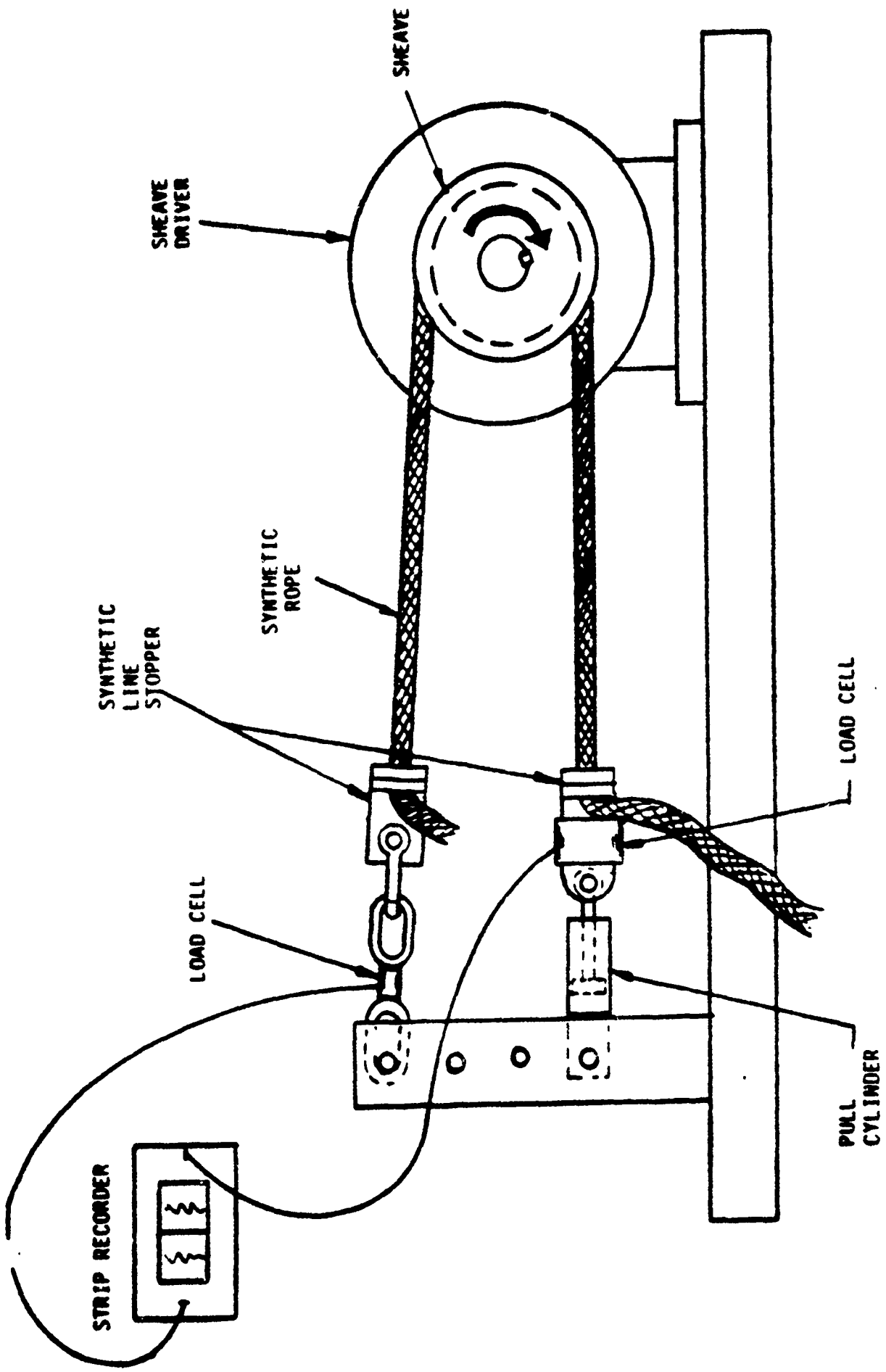


FIGURE 1. SCHEMATIC OF TEST SETUP

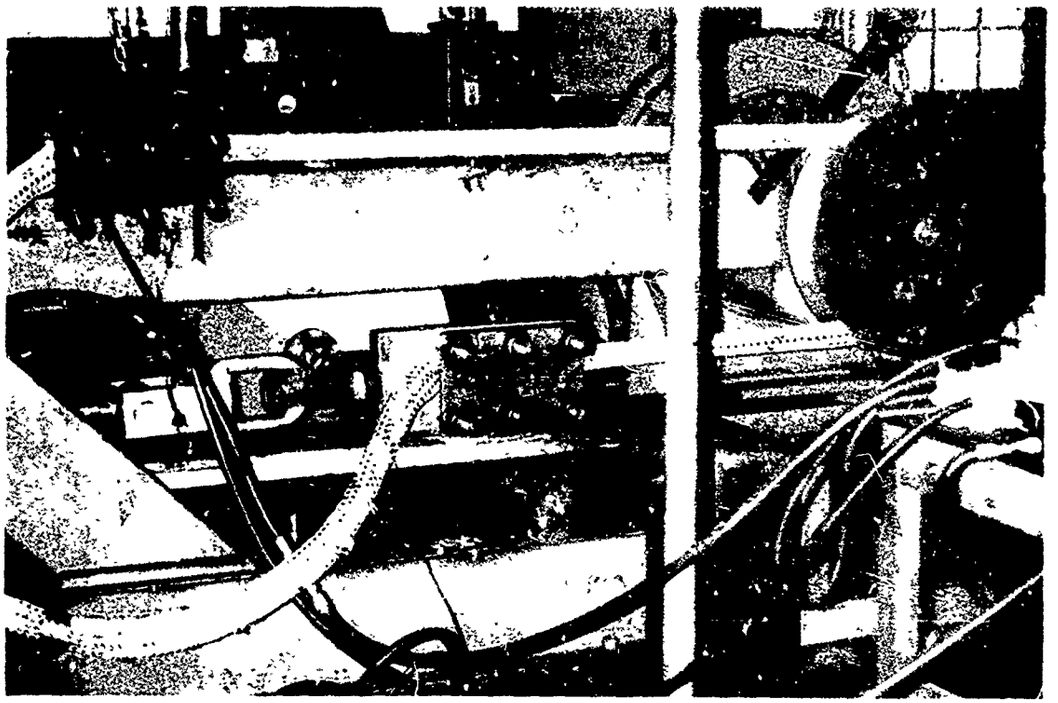


FIGURE 2. SHEAVE TEST FACILITY

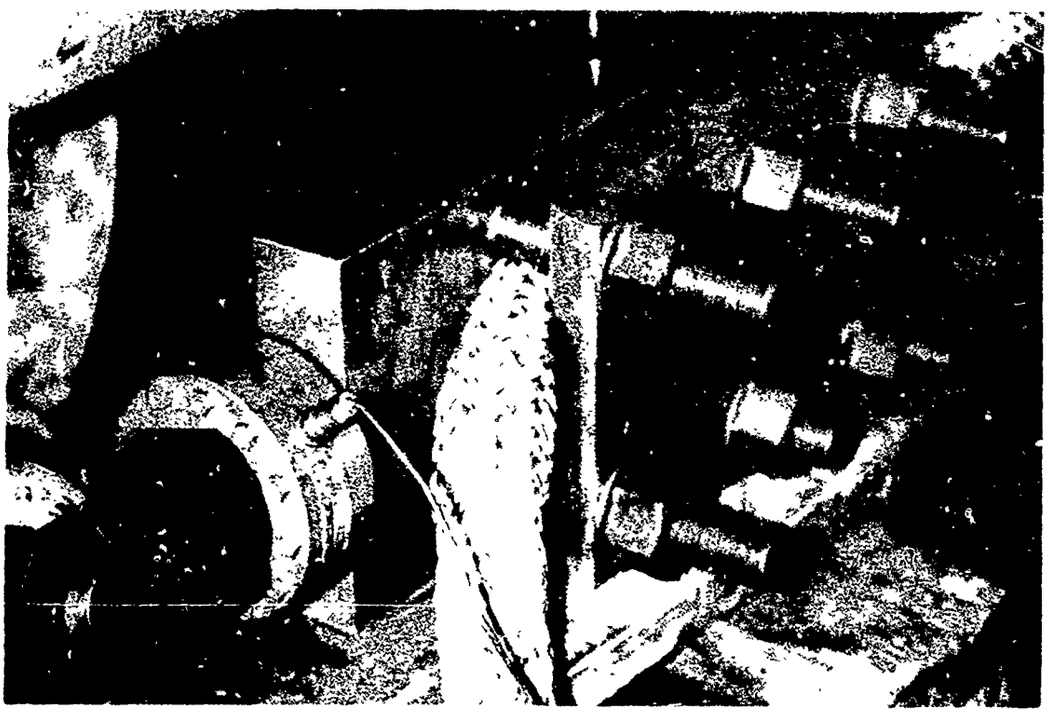


FIGURE 3. SYNTHETIC LINE STOPPER

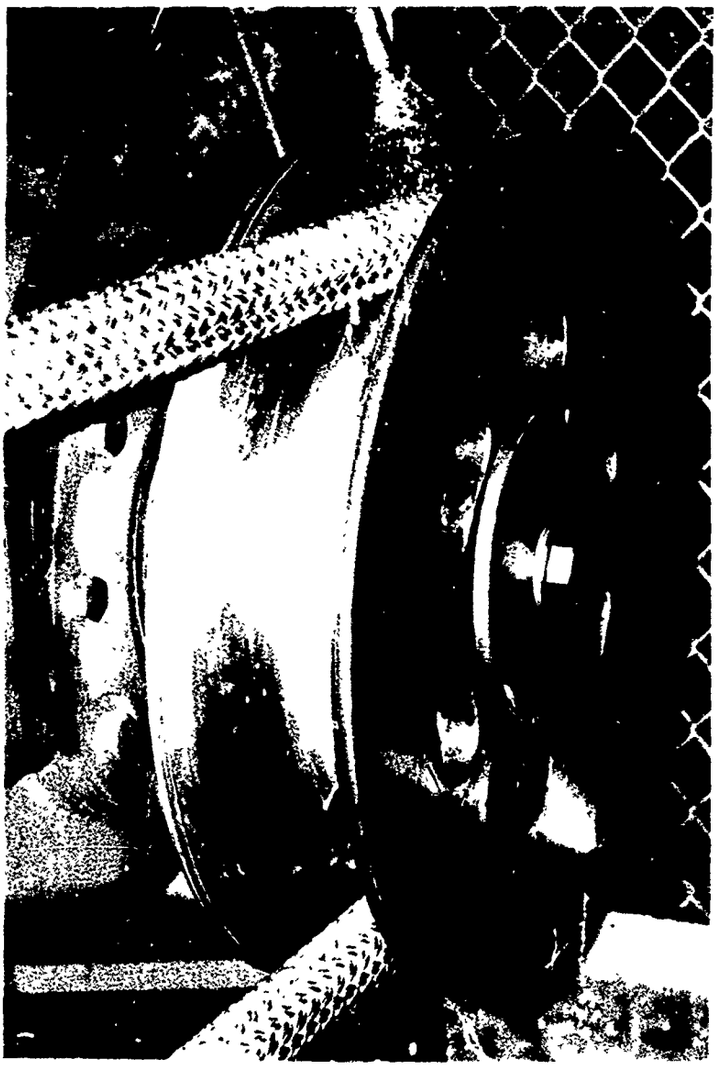
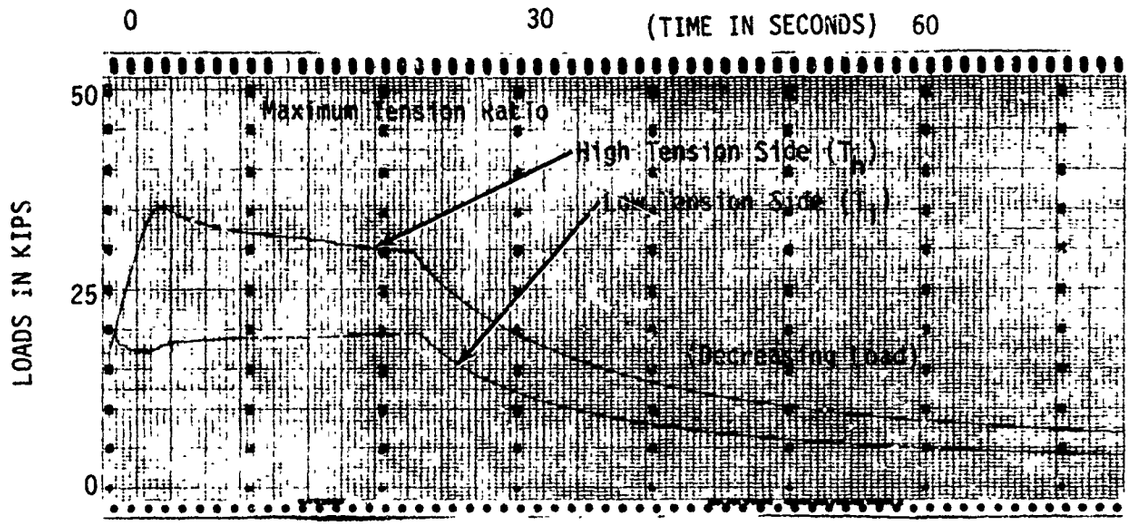
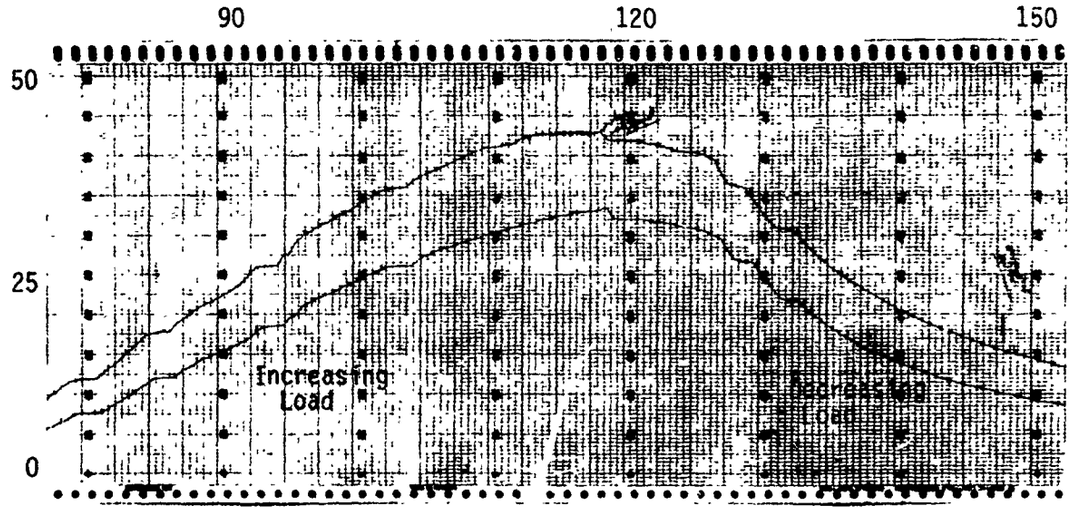


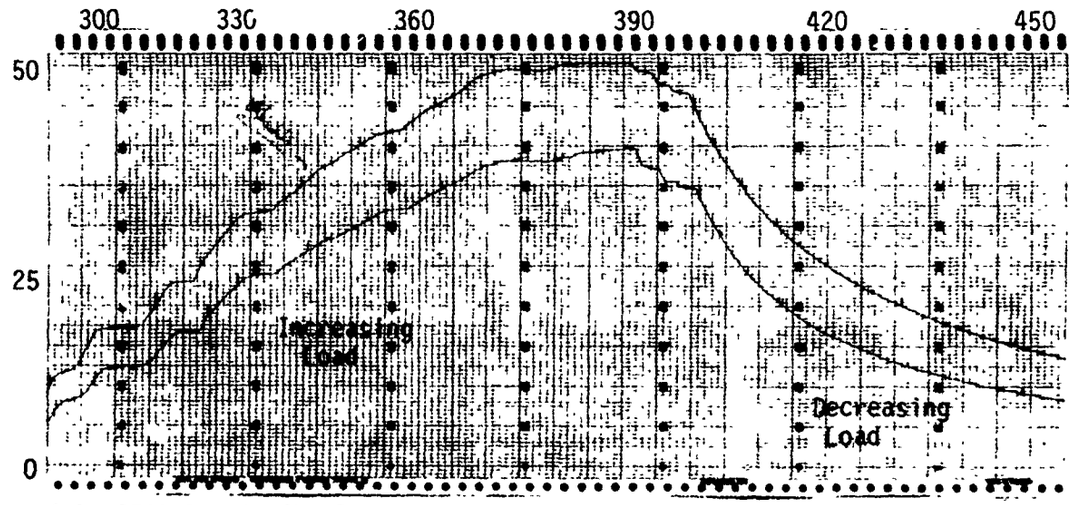
FIGURE 4. WET TEST WATER SPRAY



(A) STATIC/DYNAMIC CYCLE



(B) FIRST LOAD CYCLE



(C) SECOND LOAD CYCLE

FIGURE 5. RECORDED RESULTS OF TEST RUN #10

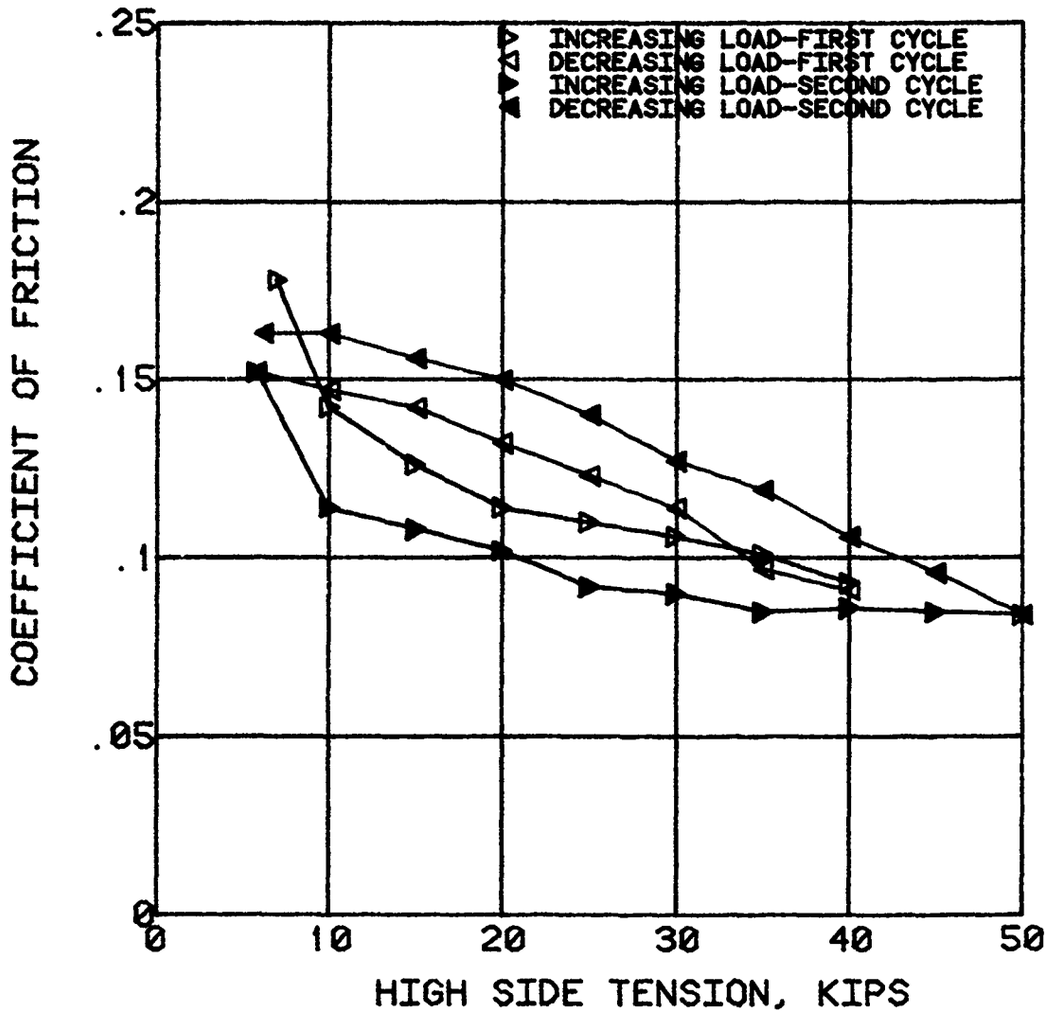


FIGURE 6. CYCLE EFFECT OF INCREASING AND DECREASING LOAD (TEST RUN #10)

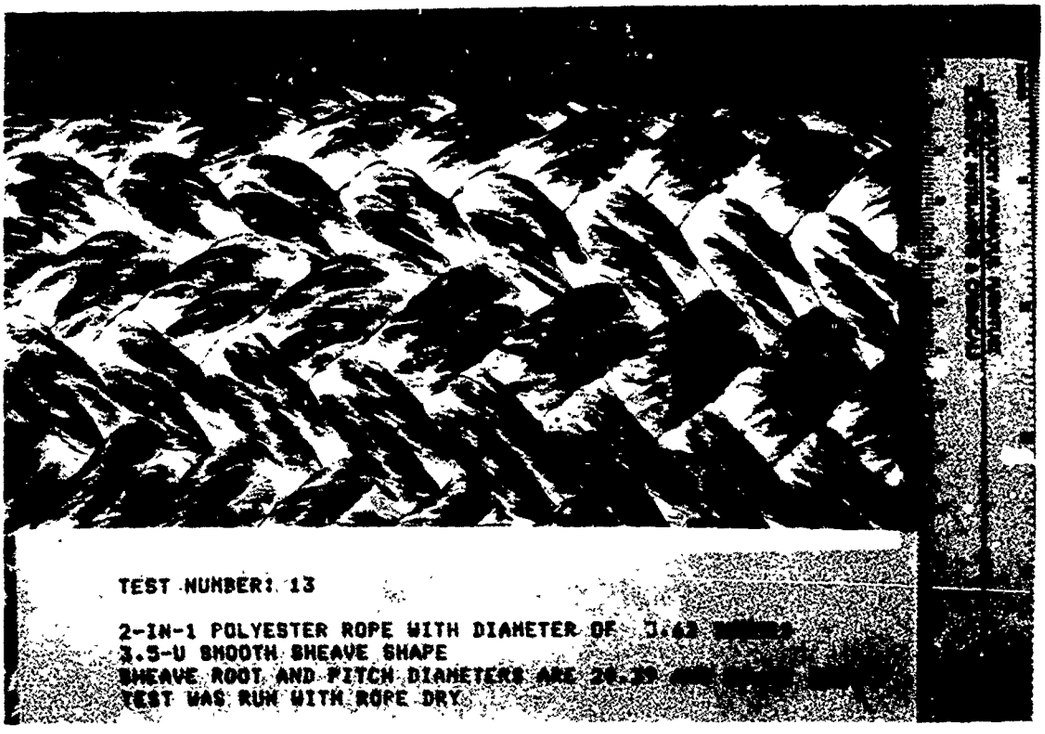


FIGURE 7. RESULT OF ROPE CONTACT WITH SHEAVE

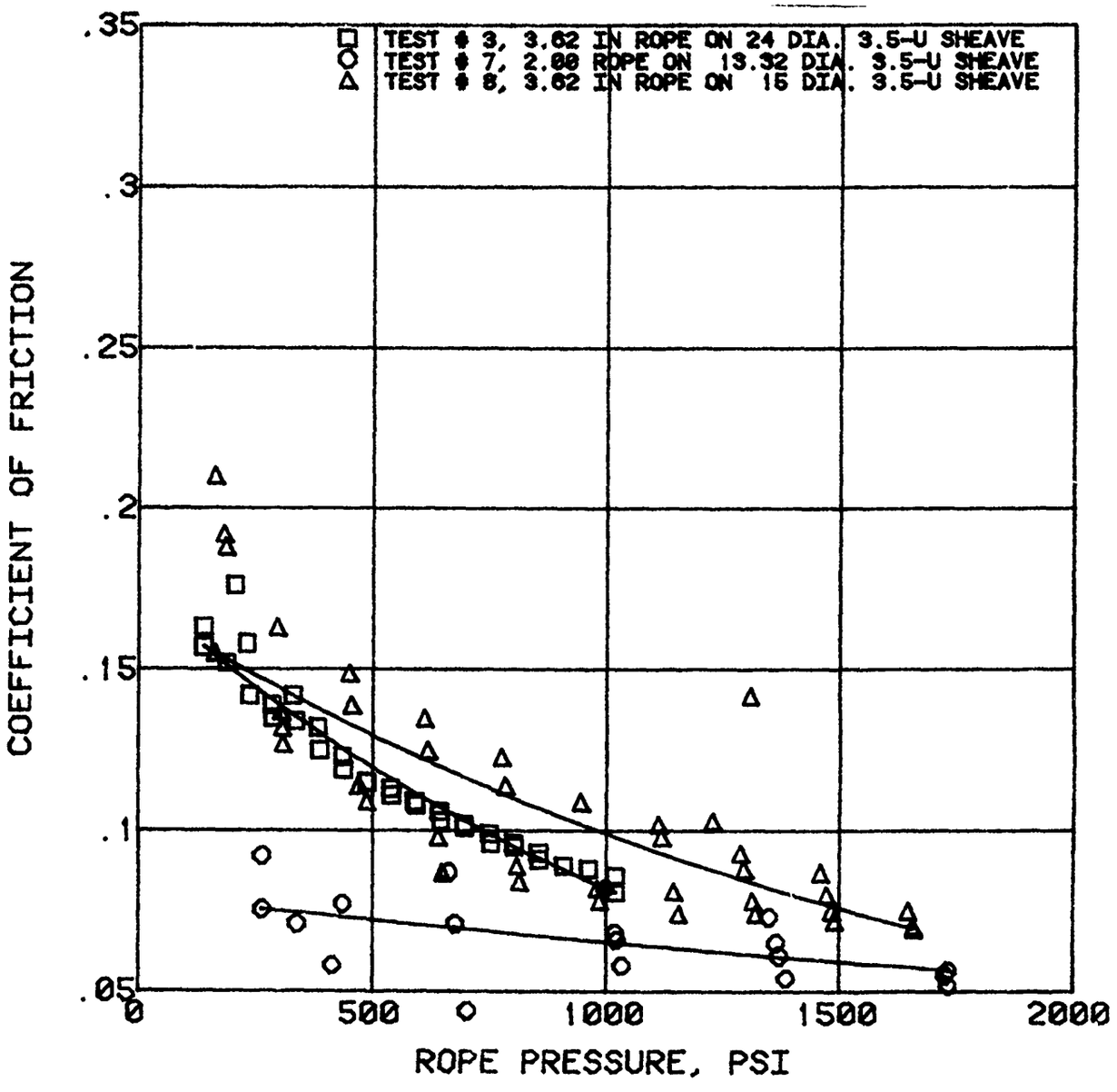


FIGURE 8. EFFECT OF ROPE PRESSURE ON 3.5-U SHEAVE

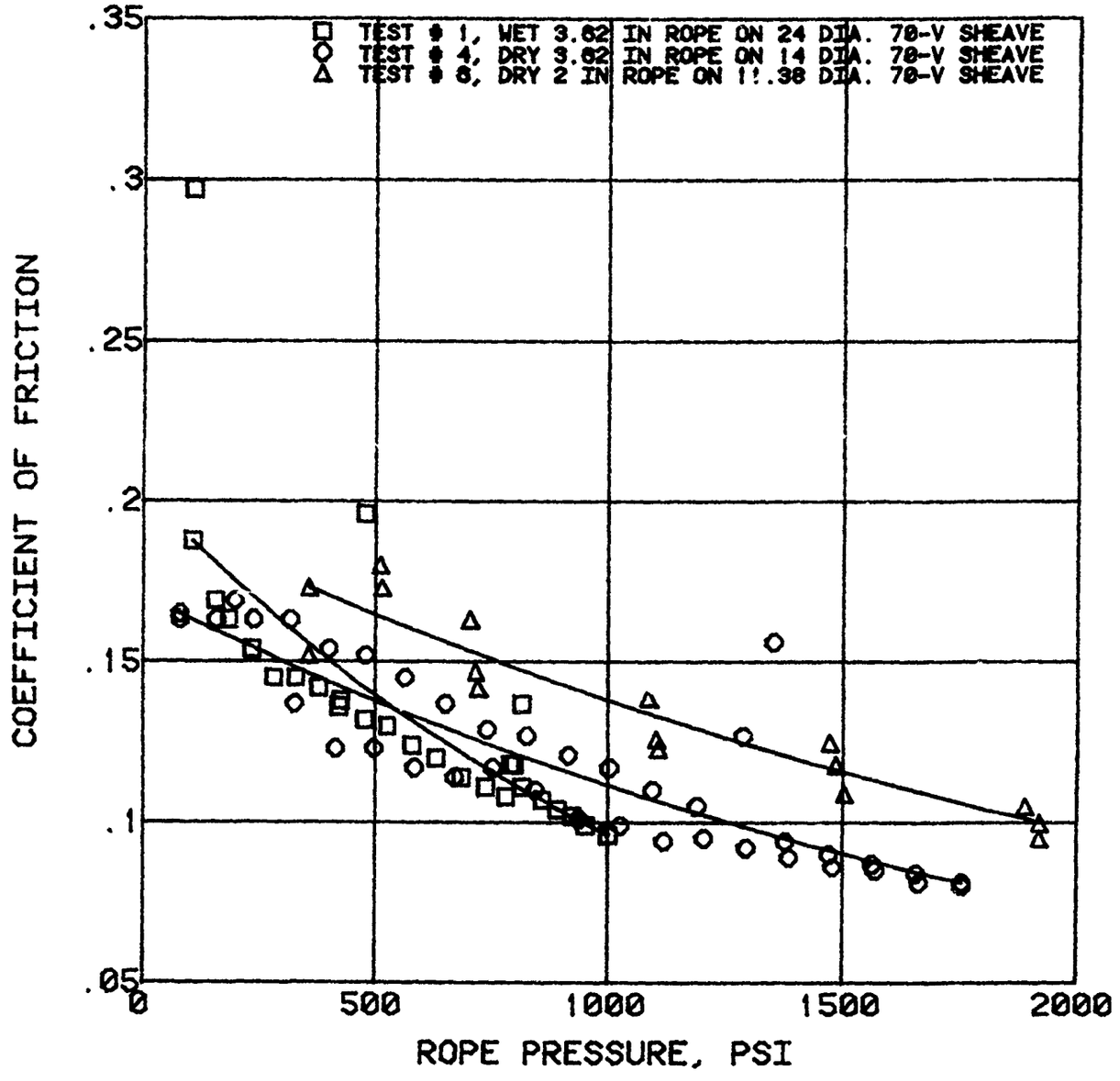


FIGURE 9. EFFECT OF ROPE PRESSURE ON 70°-V SHEAVE

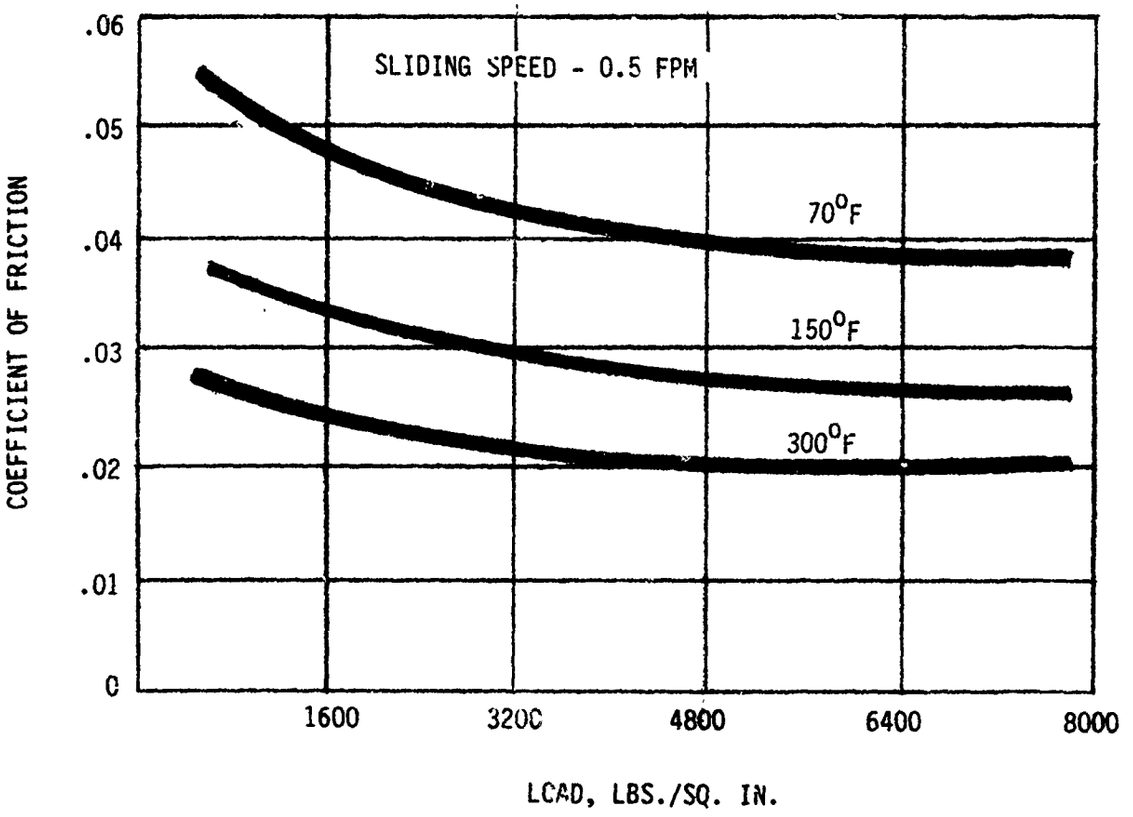


FIGURE 10. EFFECT OF LOAD ON FIBERGLIDE BEARING FRICTION (REF. 2)

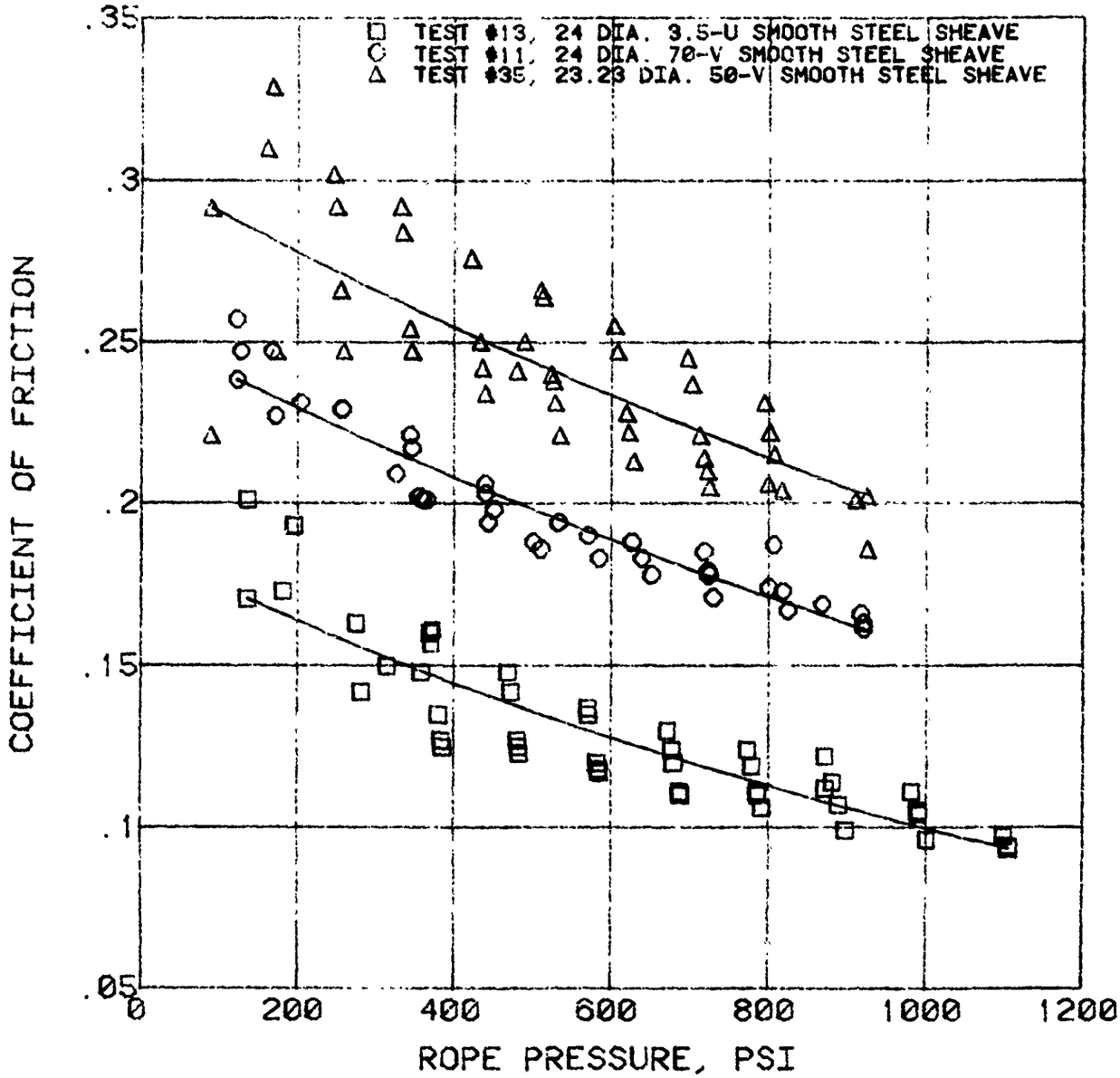


FIGURE 11. EFFECT OF GROOVE SHAPE ON DRY POLYESTER

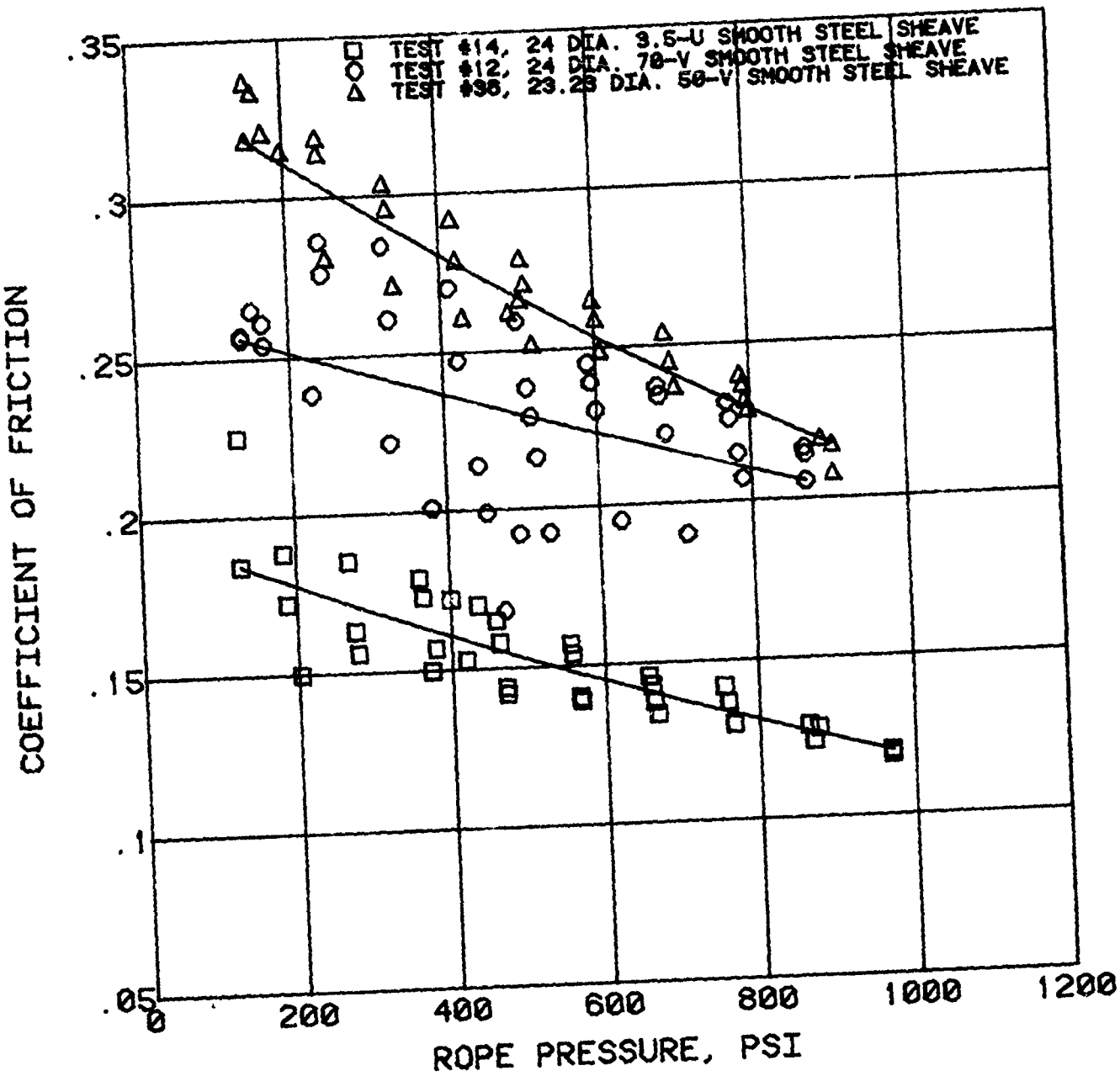


FIGURE 12. EFFECT OF GROOVE SHAPE ON WET POLYESTER

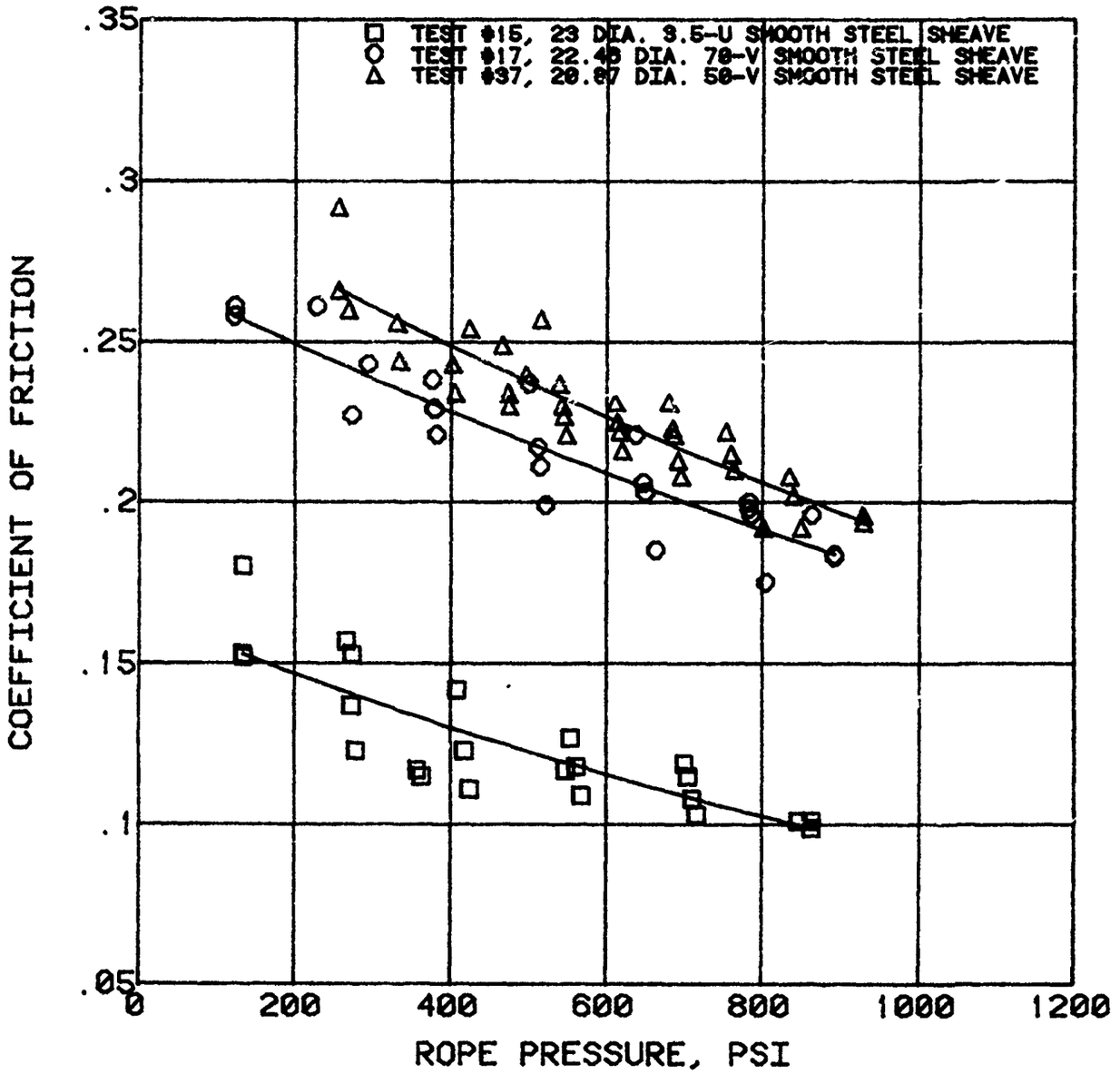


FIGURE 13. EFFECT OF GROOVE SHAPE
ON DRY NYLON

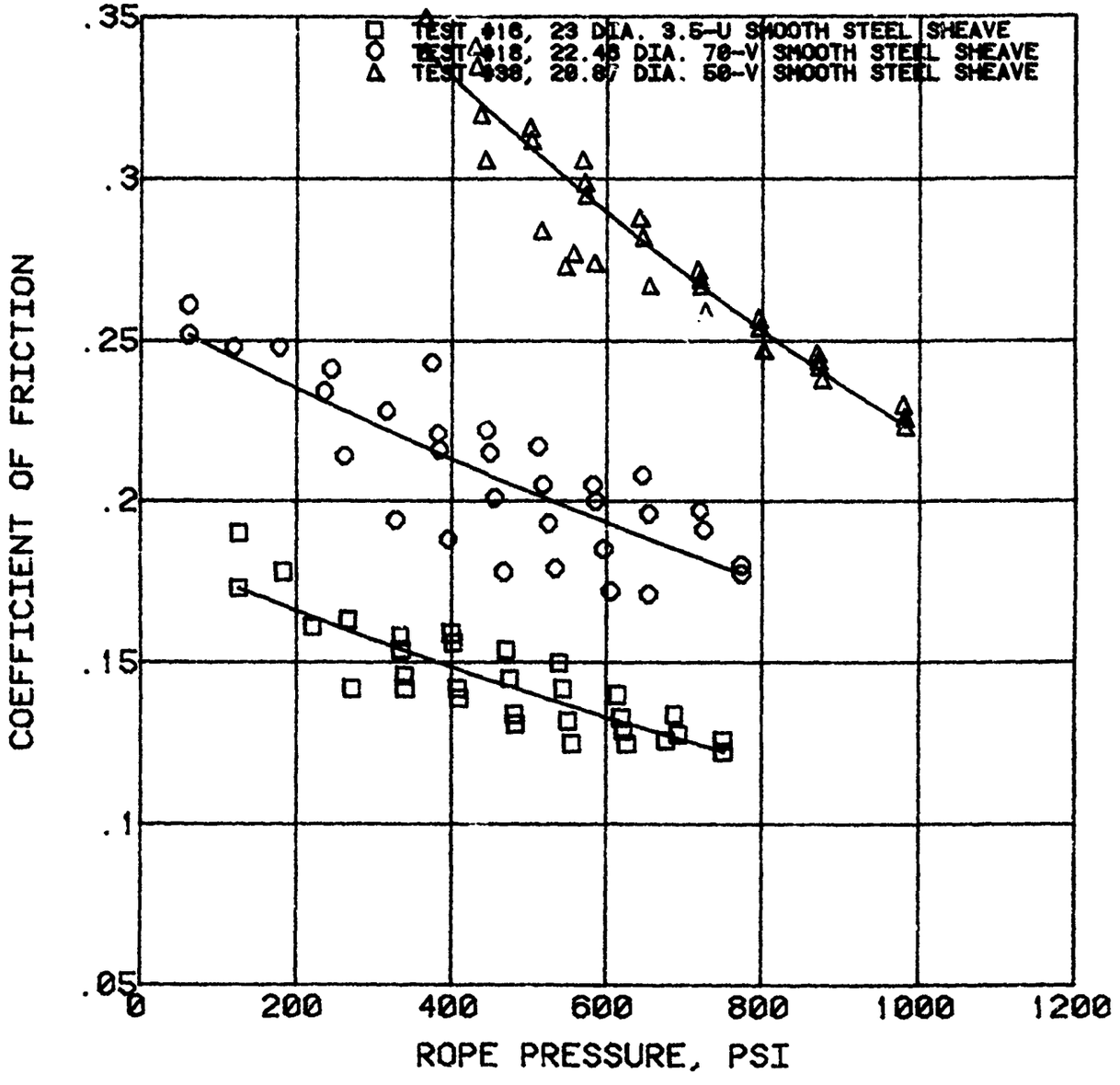


FIGURE 14. EFFECT OF GROOVE SHAPE ON WET NYLON

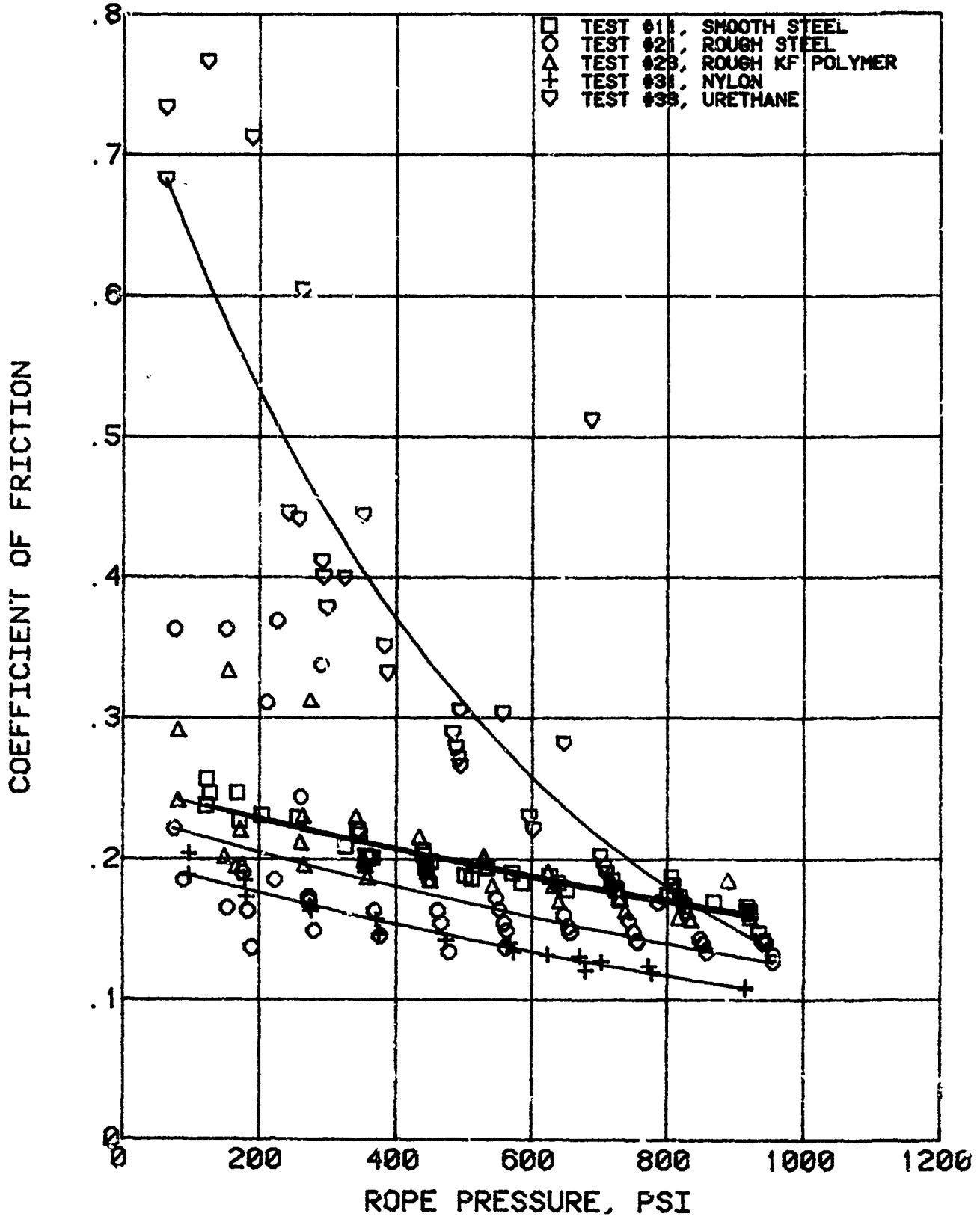


FIGURE 15. EFFECT OF GROOVE SURFACE ON DRY POLYESTER

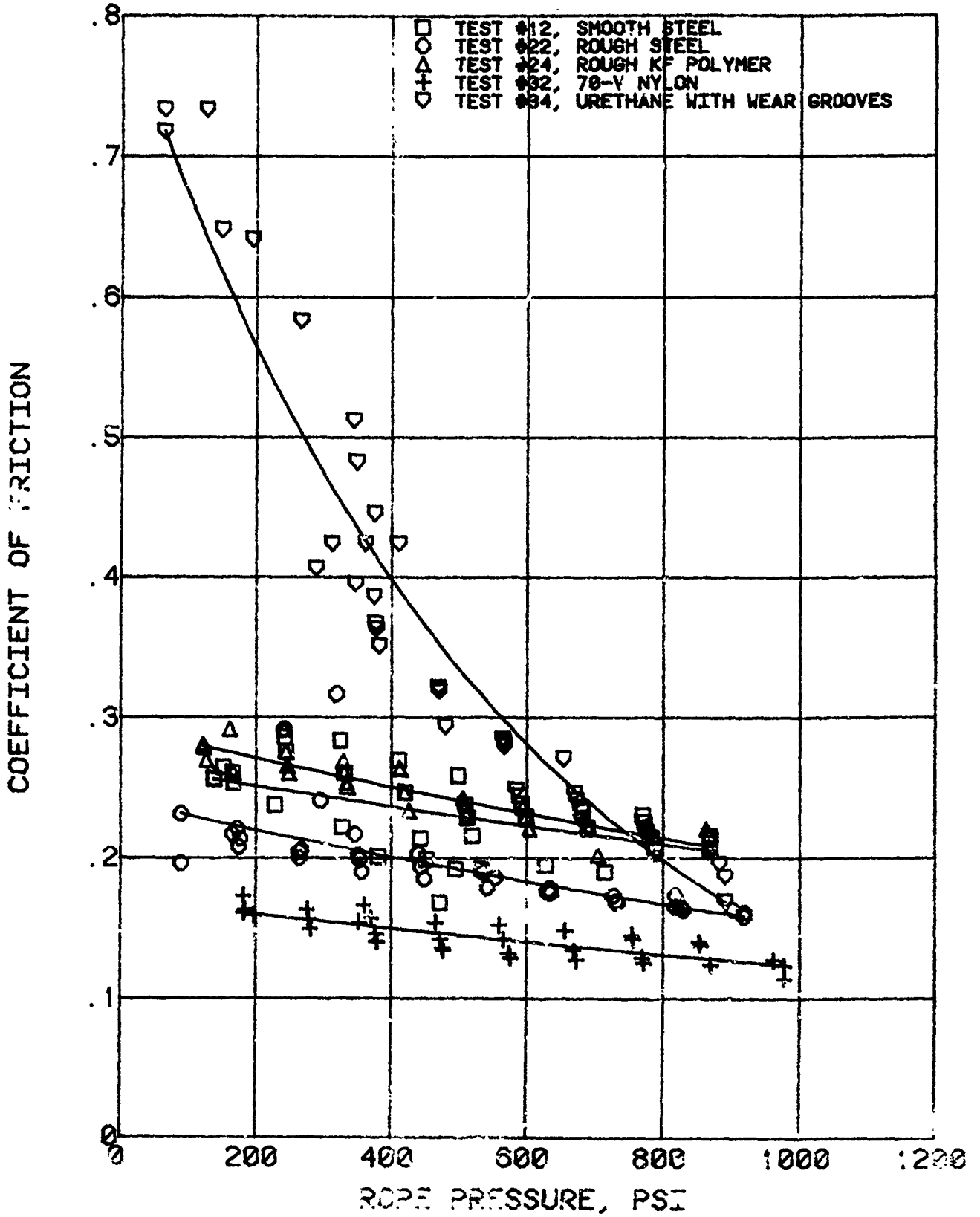
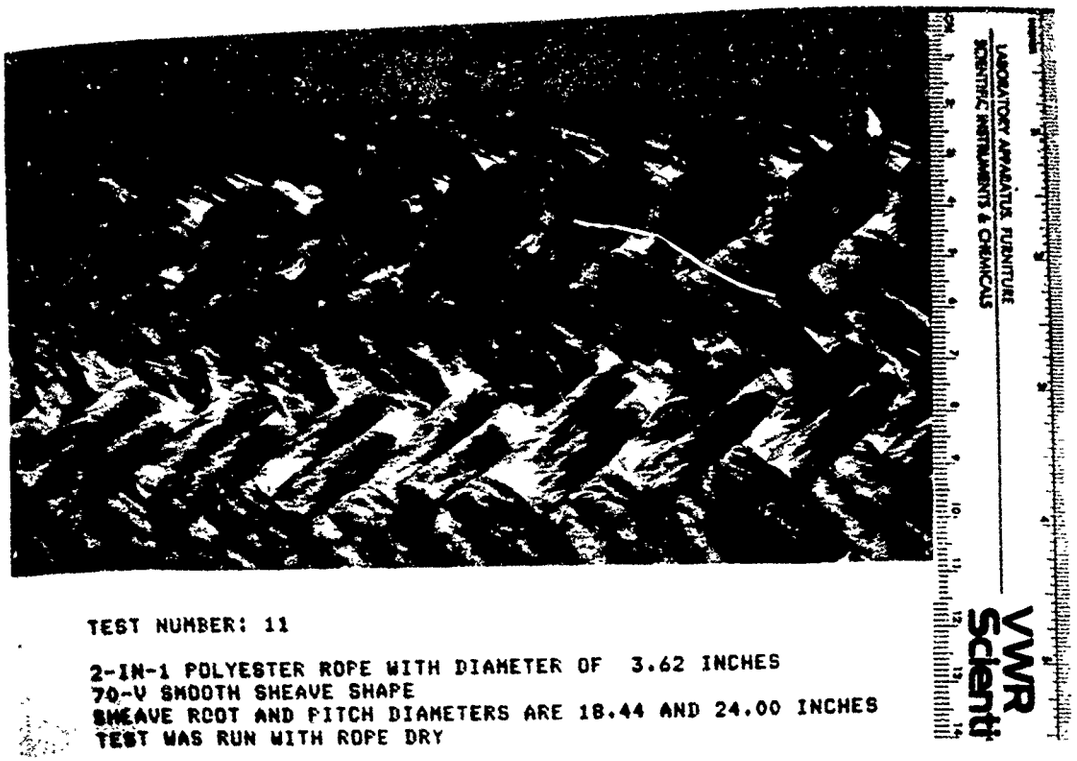
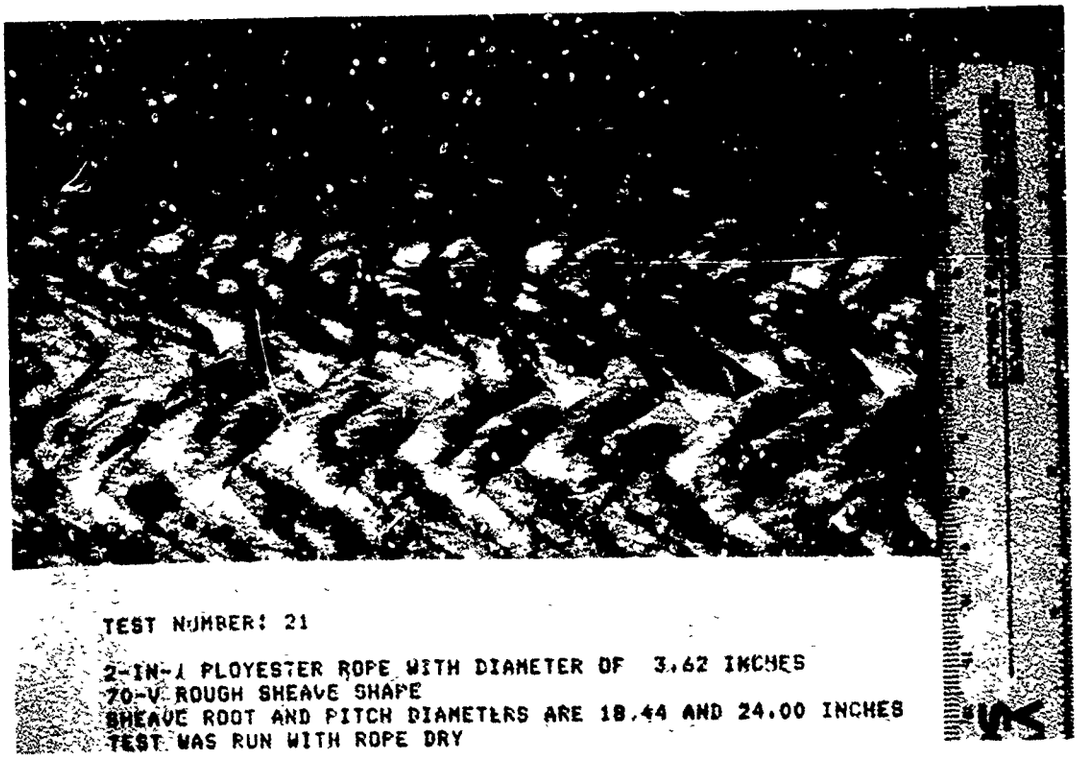


FIGURE [illegible] ROLVE SURFACE
TESTER



TEST NUMBER: 11

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY



TEST NUMBER: 21

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

FIGURE 17. EXAMPLES OF THE DIFFERENCE IN WEAR ON POLYESTER ROPE BETWEEN SMOOTH AND ROUGH SHEAVES

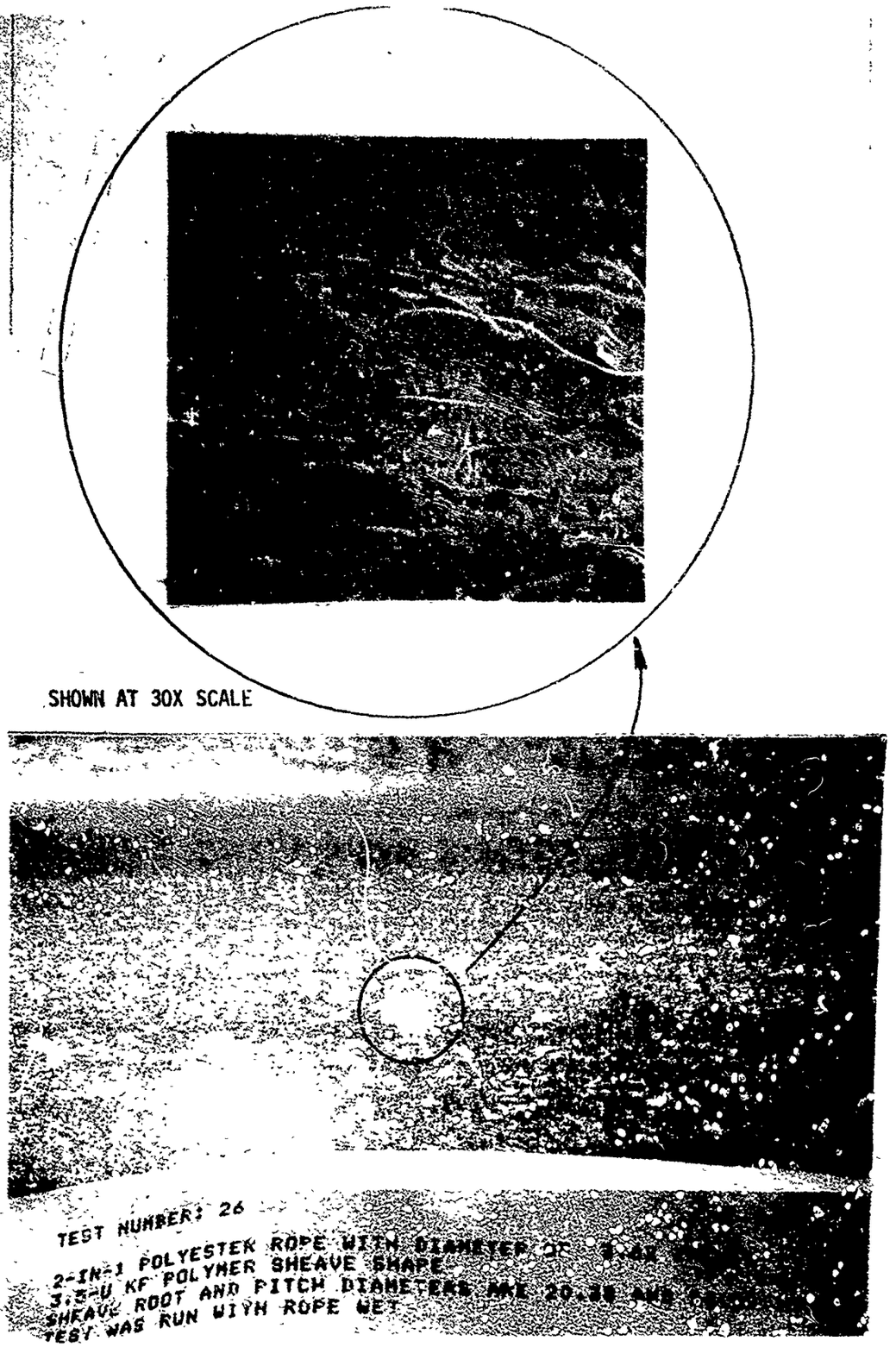


FIGURE 18. EXAMPLE OF ABRADED ROPE ON ROUGH SHEAVE SURFACE

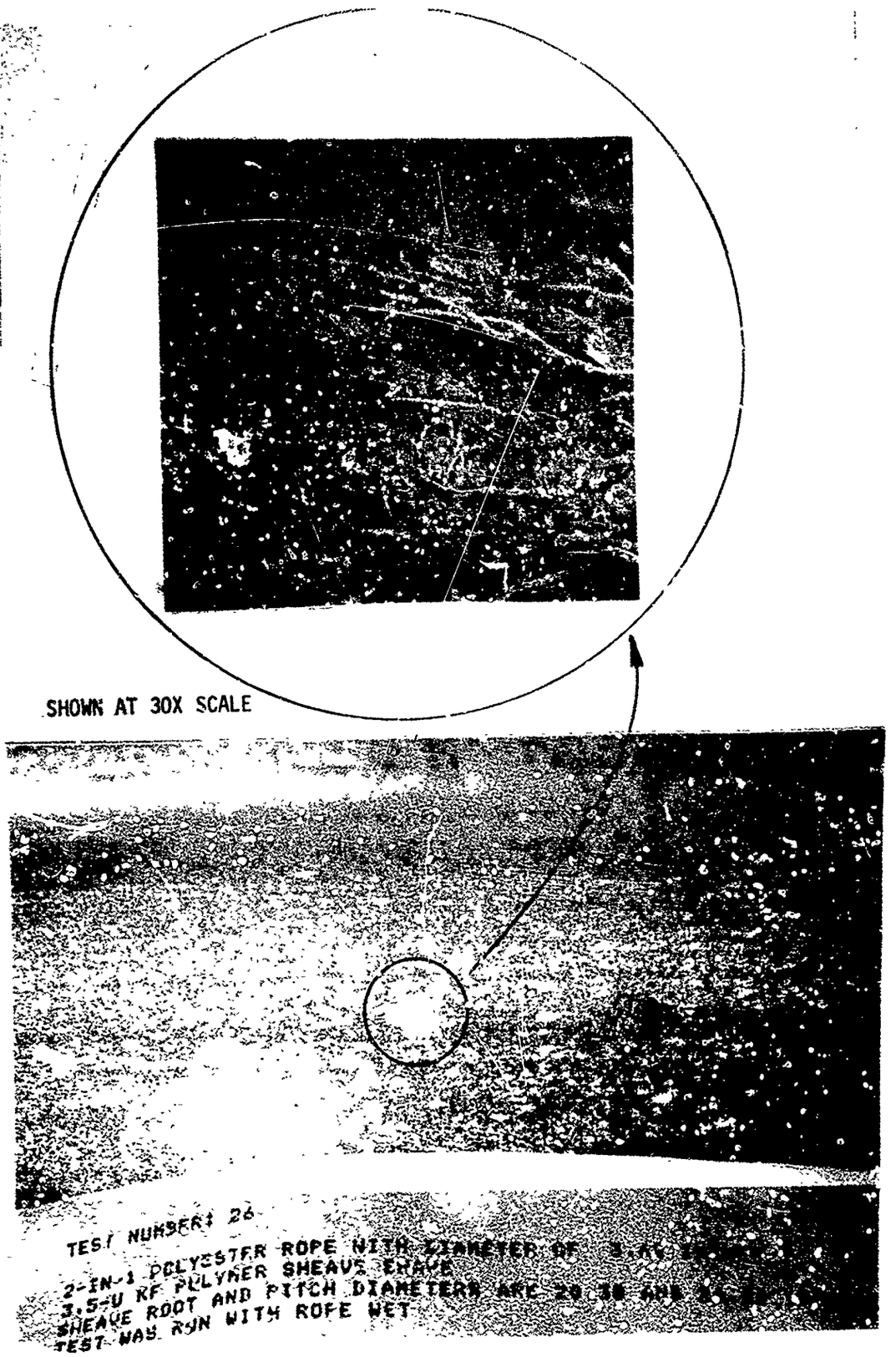


FIGURE 18. EXAMPLE OF ABRADED ROPE ON ROUGH SHEAVE SURFACE

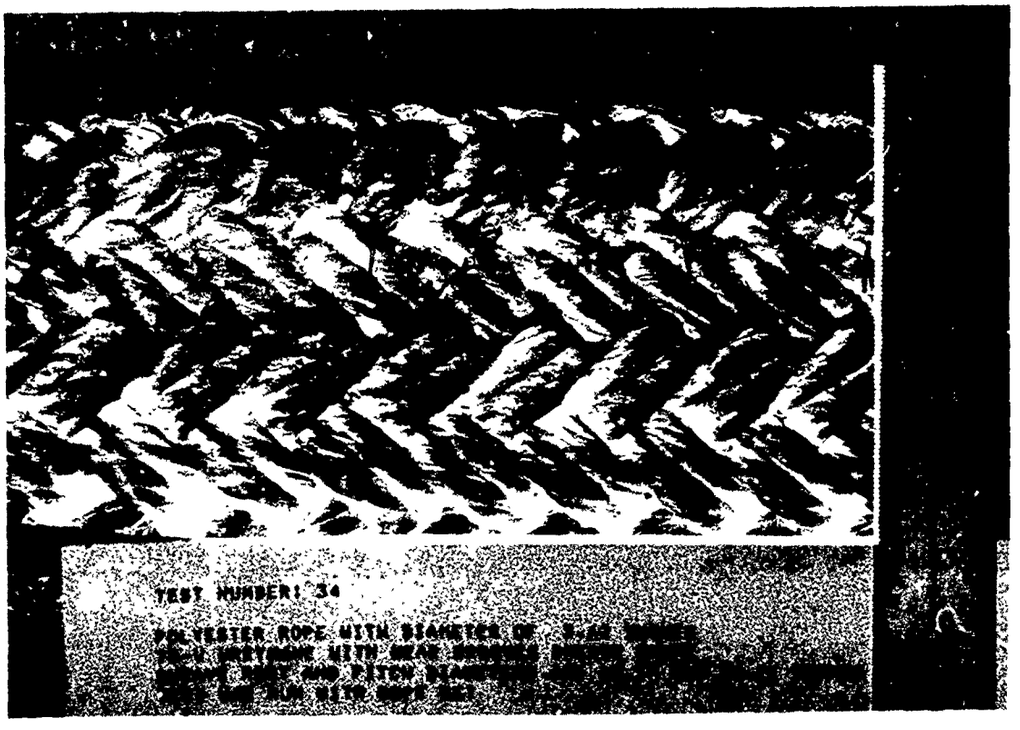


FIGURE 19. POLYESTER ROPE EMBEDDED WITH URETHANE SHEAVE COATING

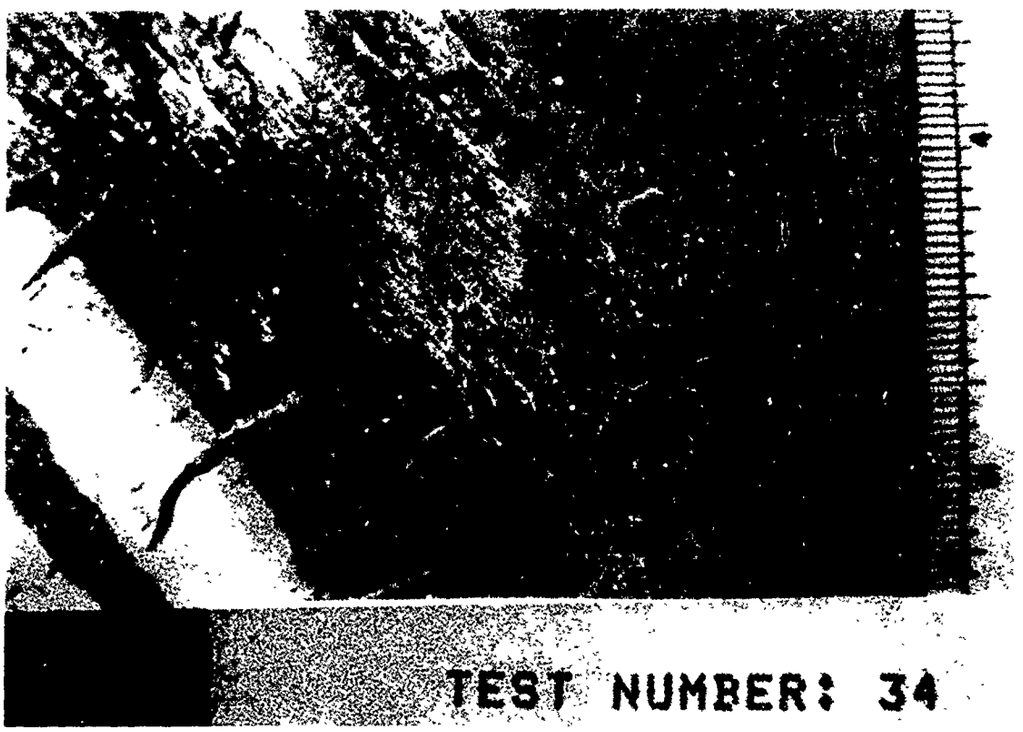


FIGURE 20. WEAR ON URETHANE COATED SHEAVE

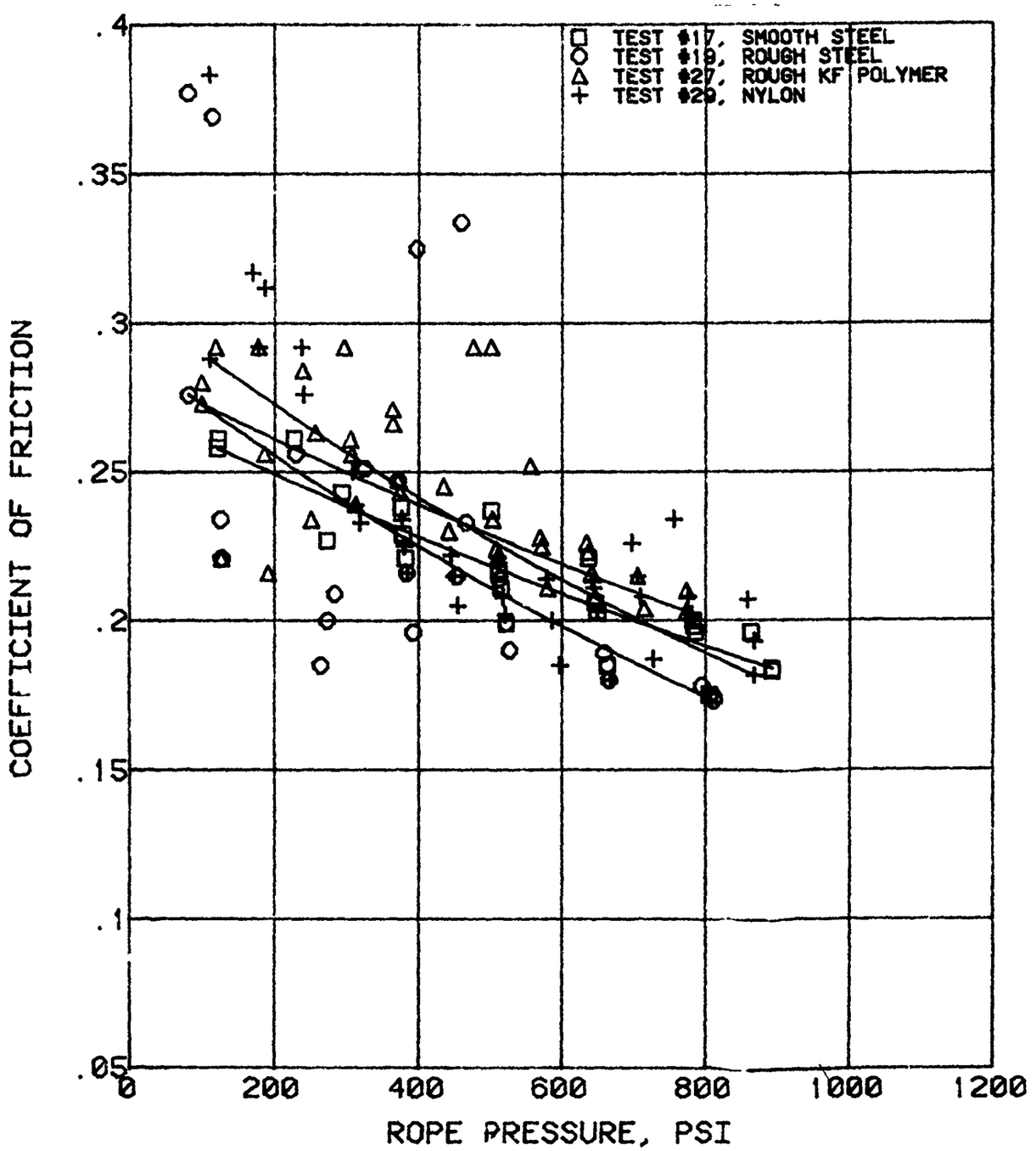


FIGURE 21. EFFECT OF GROOVE SURFACE ON DRY NYLON

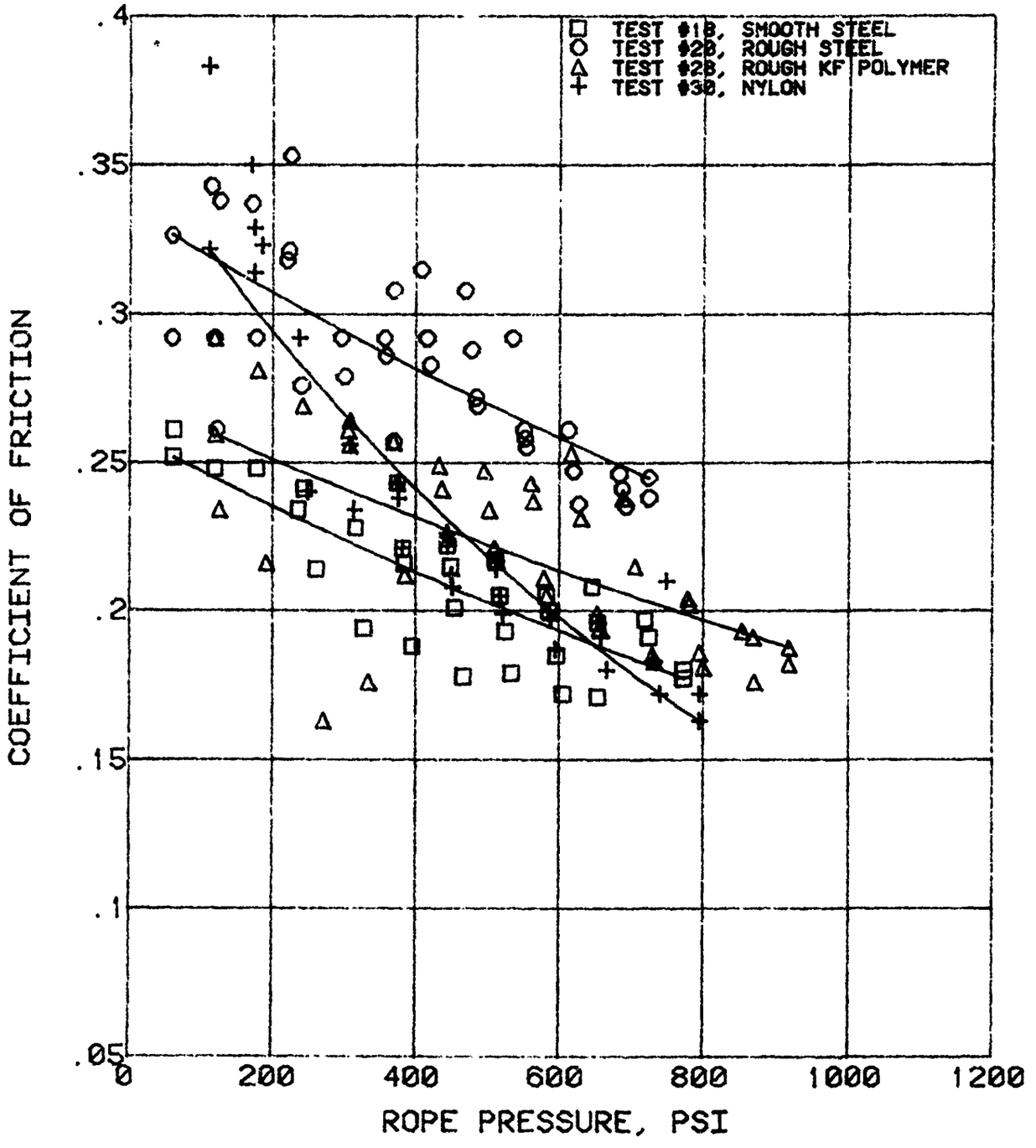
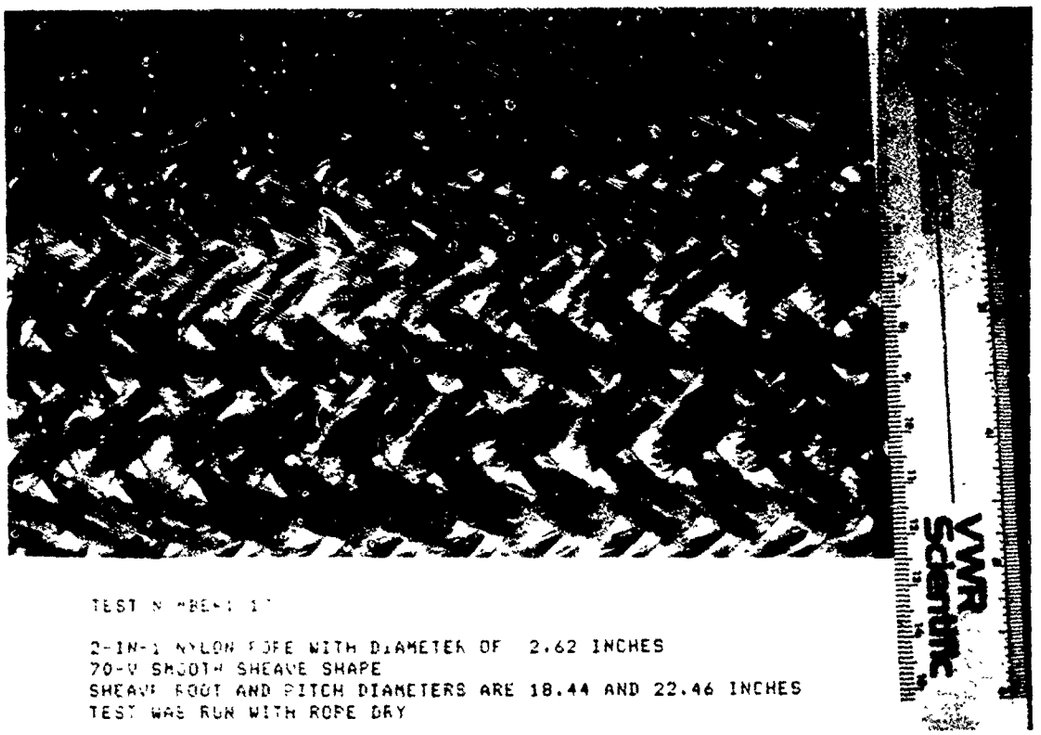
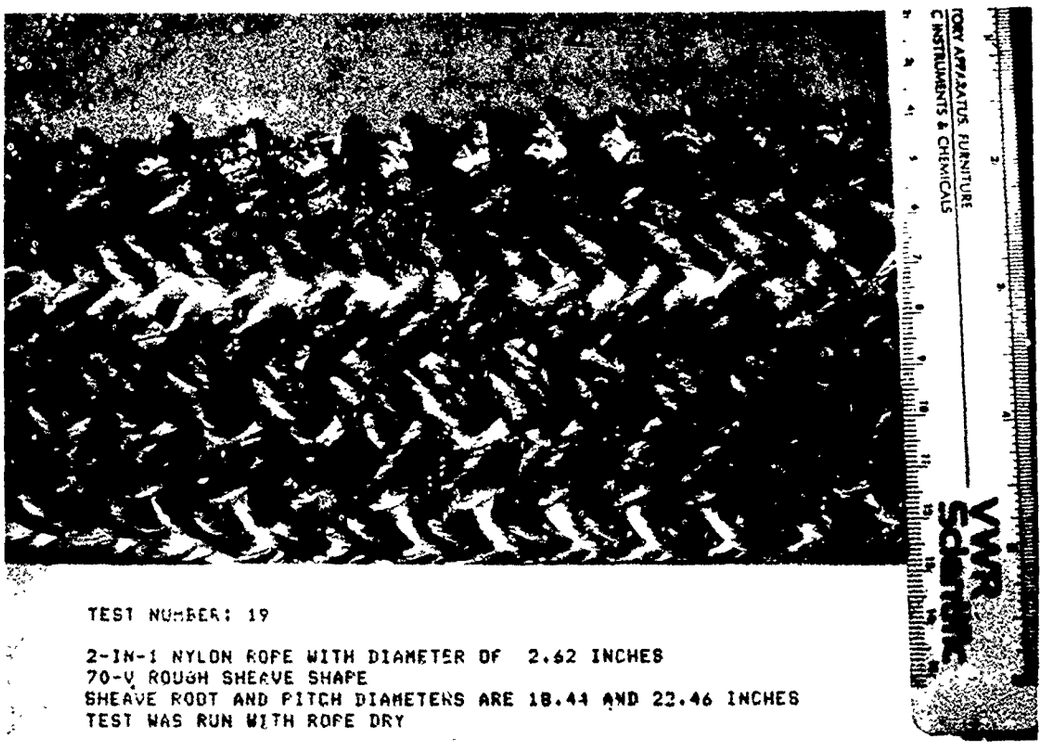


FIGURE 22. EFFECT OF GROOVE SURFACE ON WET NYLON



TEST NUMBER: 17

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY



TEST NUMBER: 19

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY

FIGURE 23. EXAMPLE OF THE DIFFERENCE IN WEAR ON NYLON ROPE BETWEEN SMOOTH AND ROUGH SHEAVES

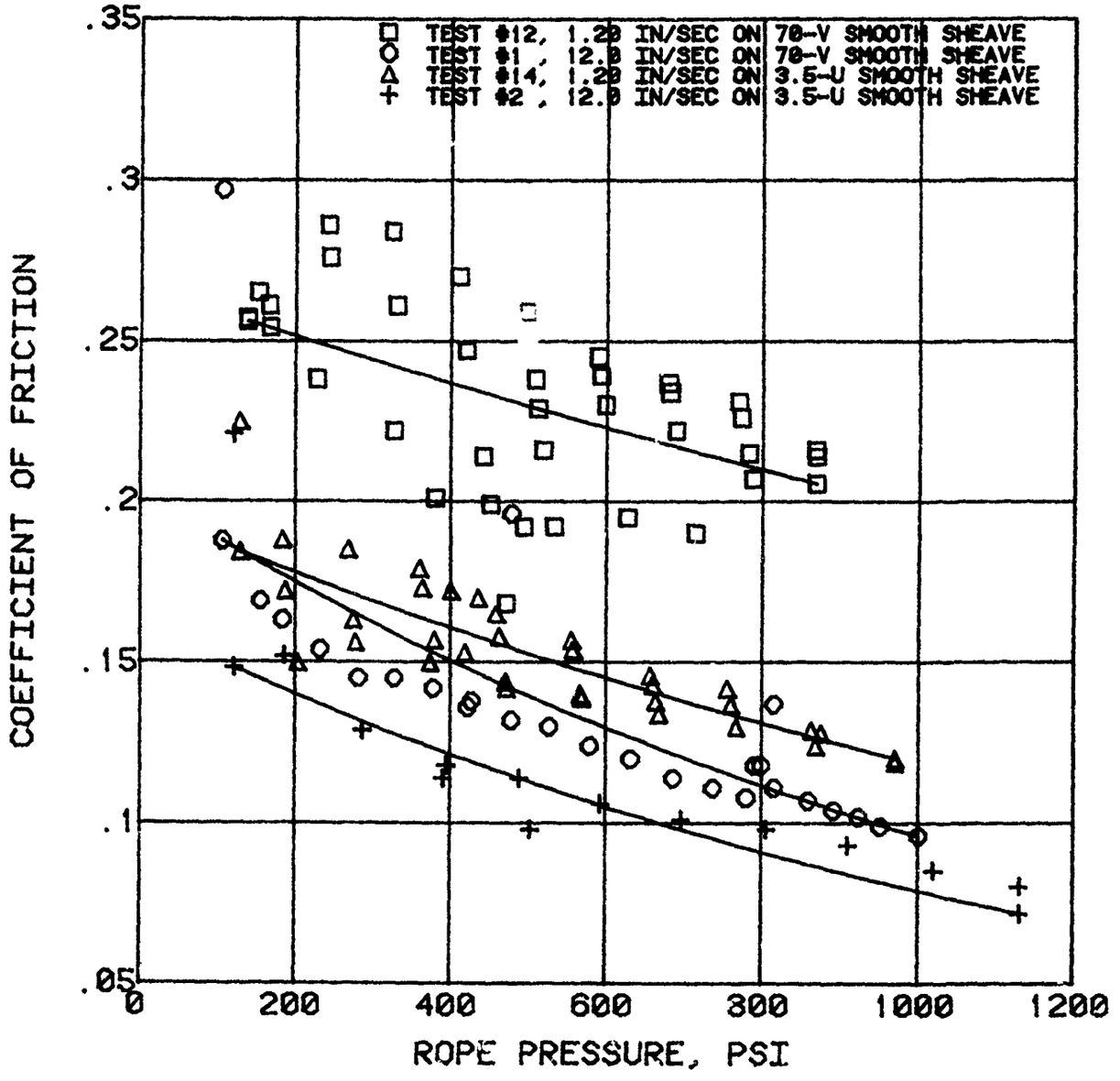


FIGURE 24. EFFECT OF RELATIVE VELOCITY

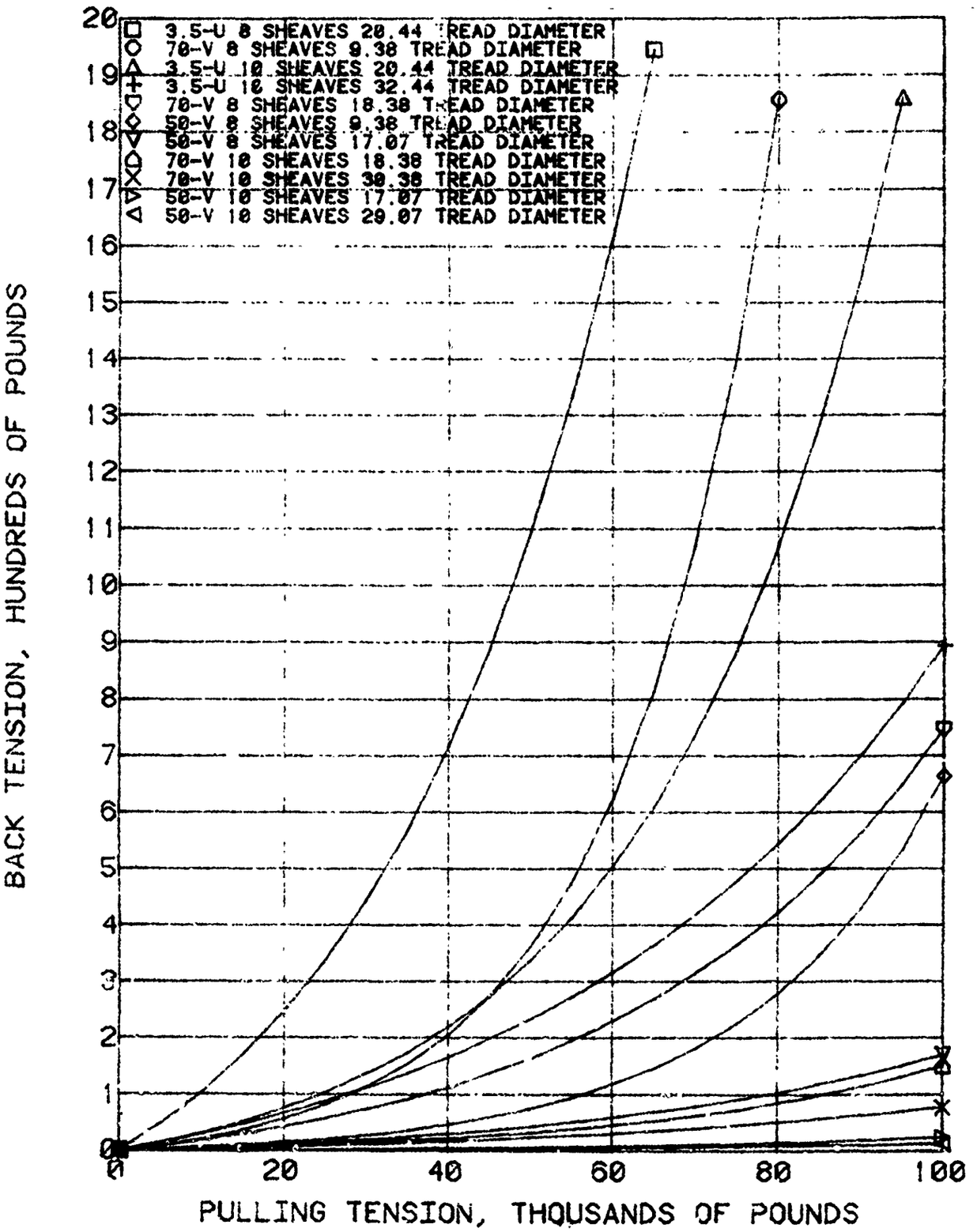


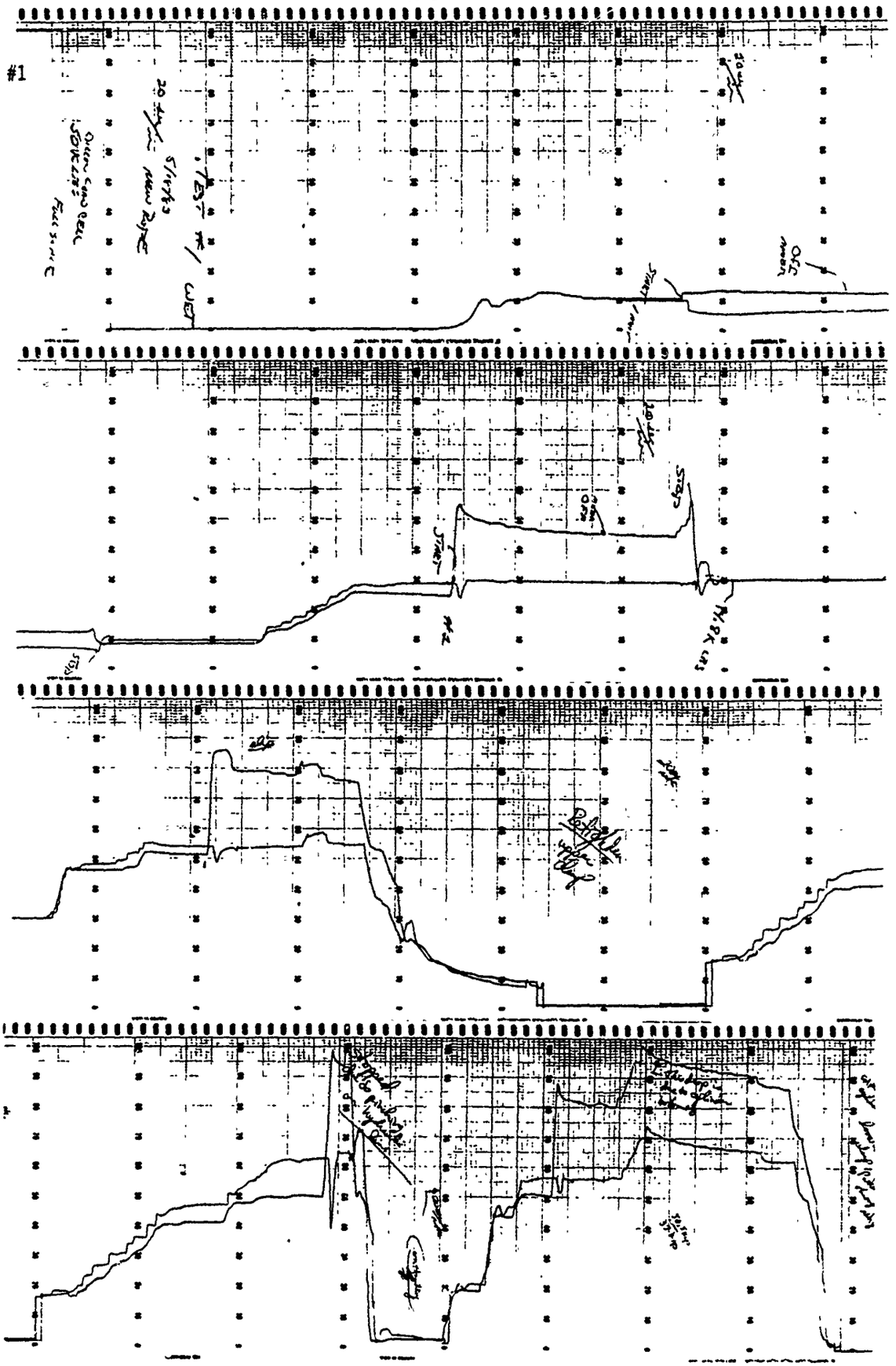
FIGURE 25. ESTIMATED BACK TENSION

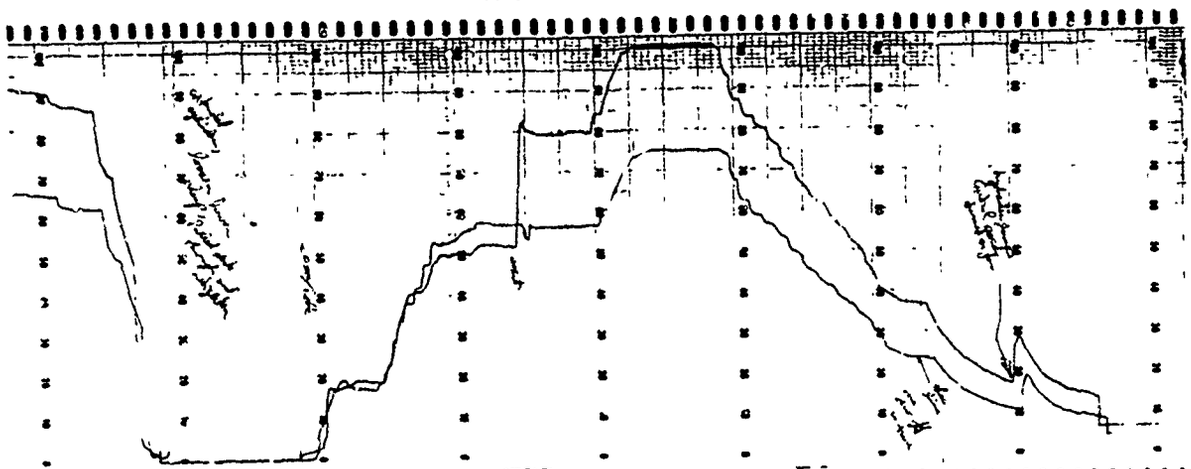
APPENDIX A

REDUCED COPIES OF STRIP CHART RECORDINGS

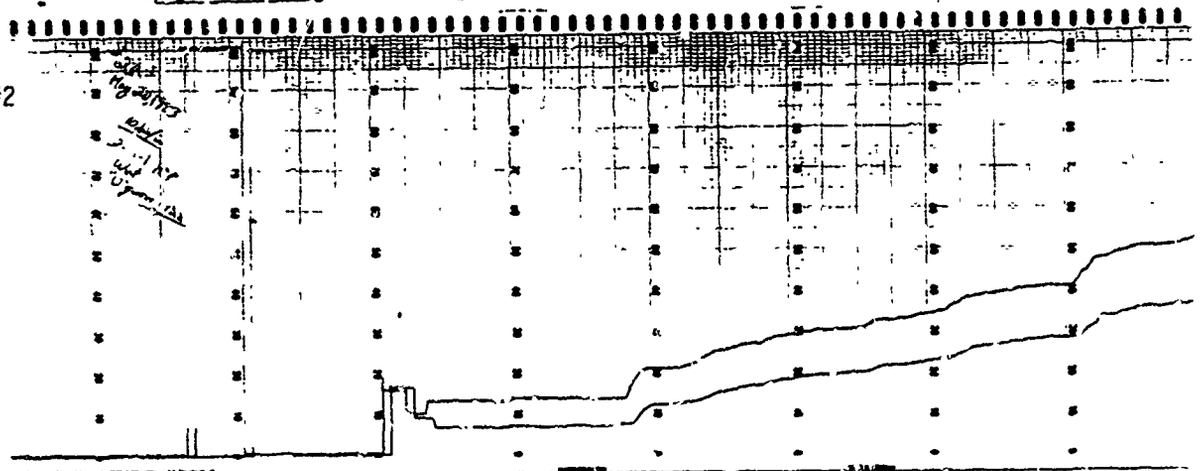
(See Figure 5 of Report for Description of Chart Parameters)
(See Table 3 of Report for Summary of Test Parameters)

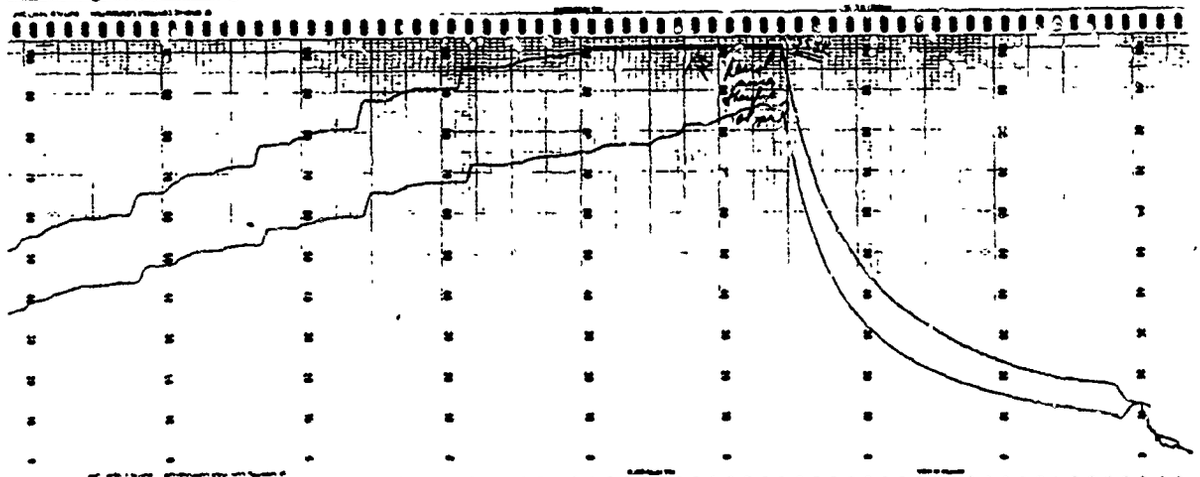
Test #1



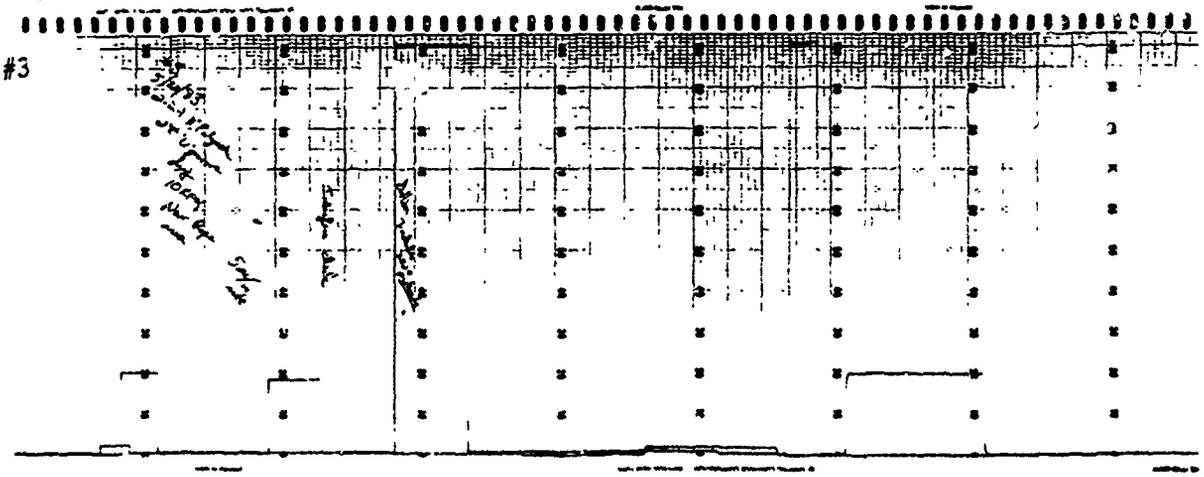


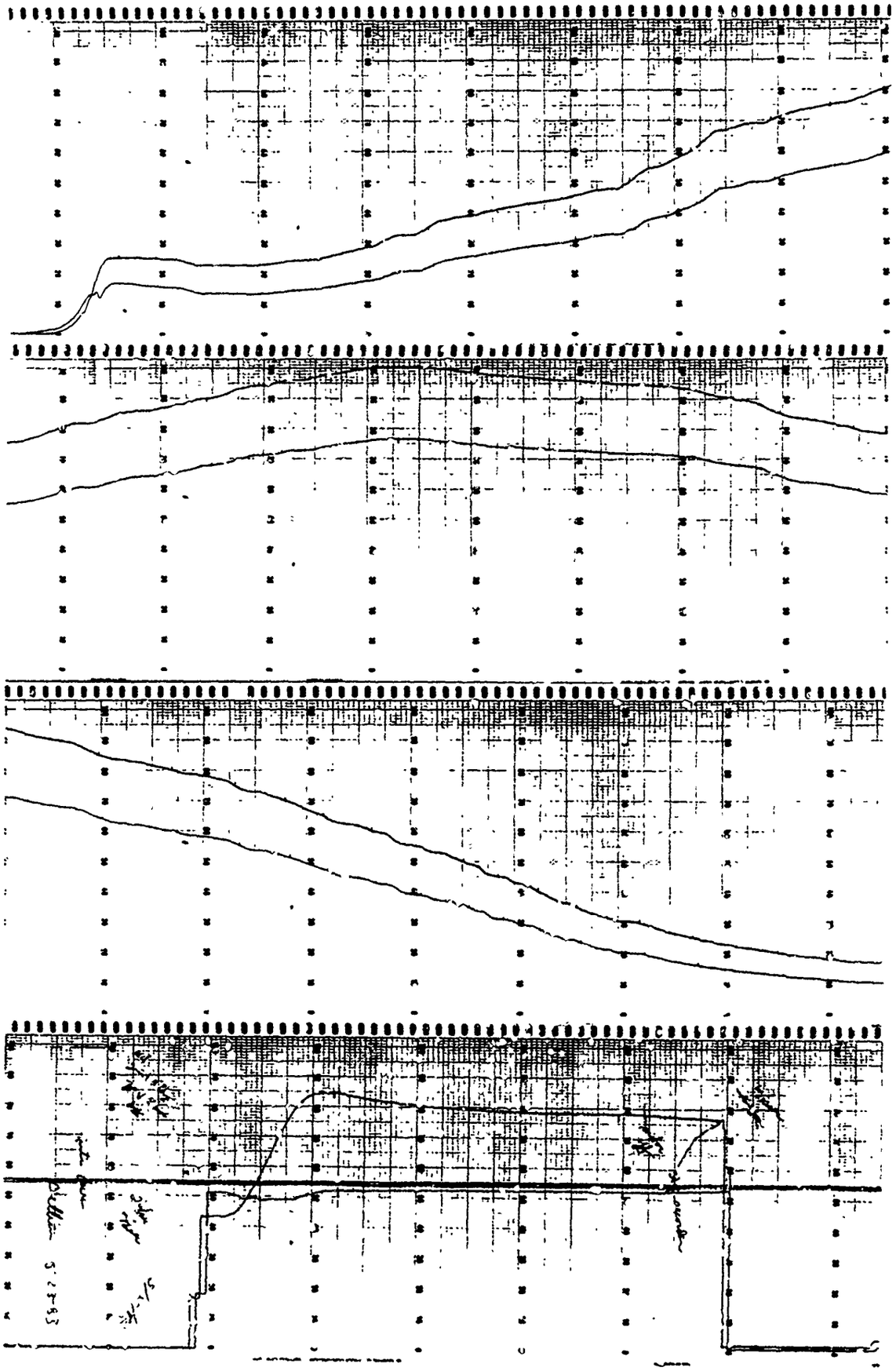
Test #2





Test #3





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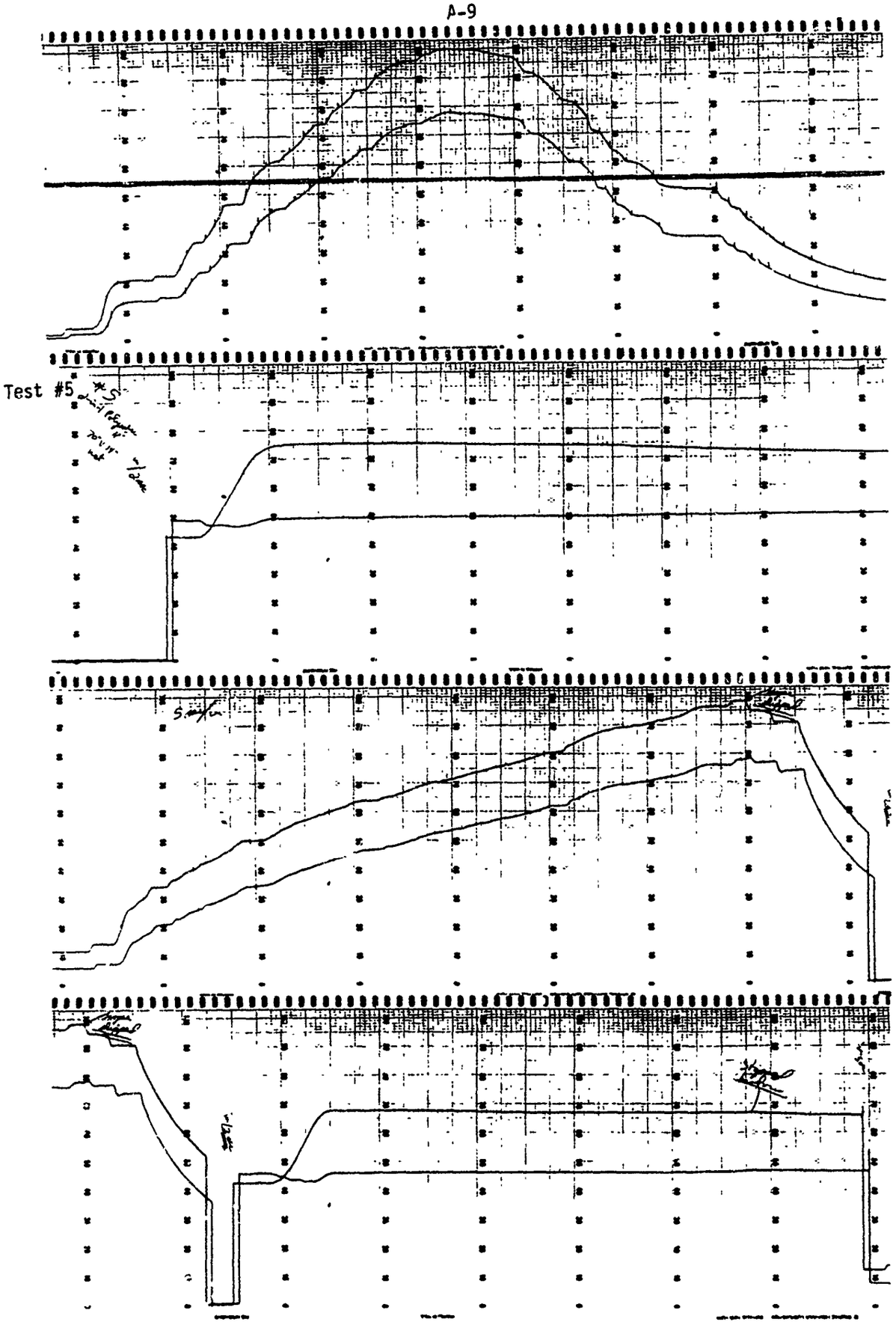
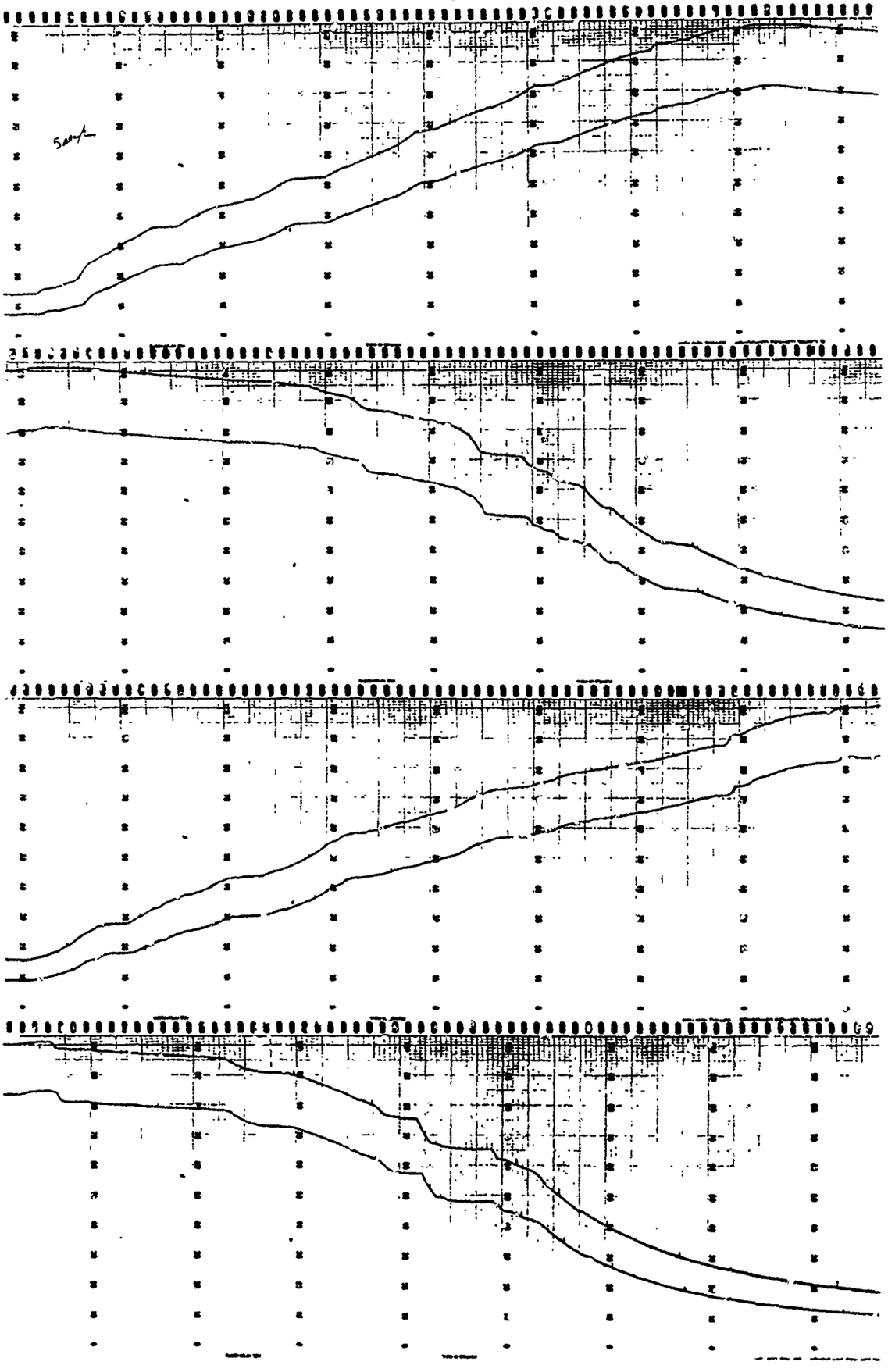
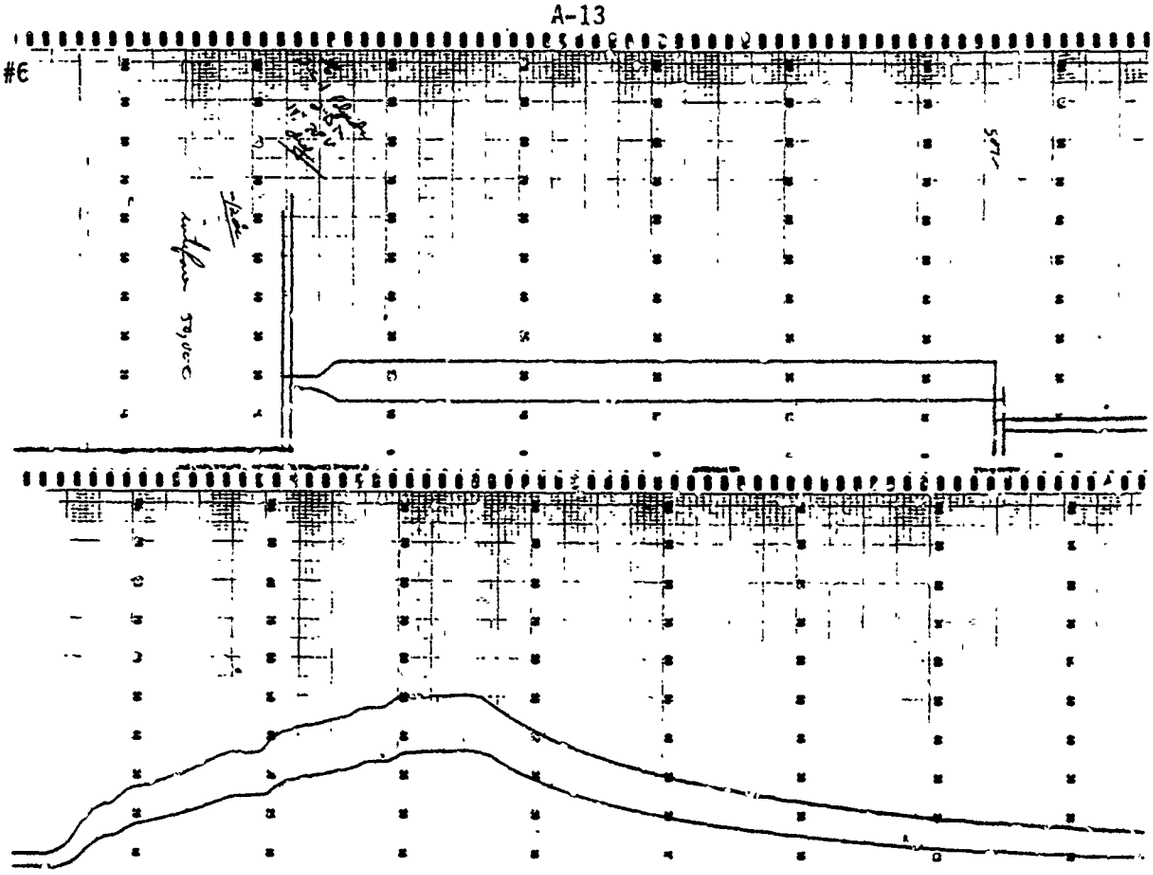
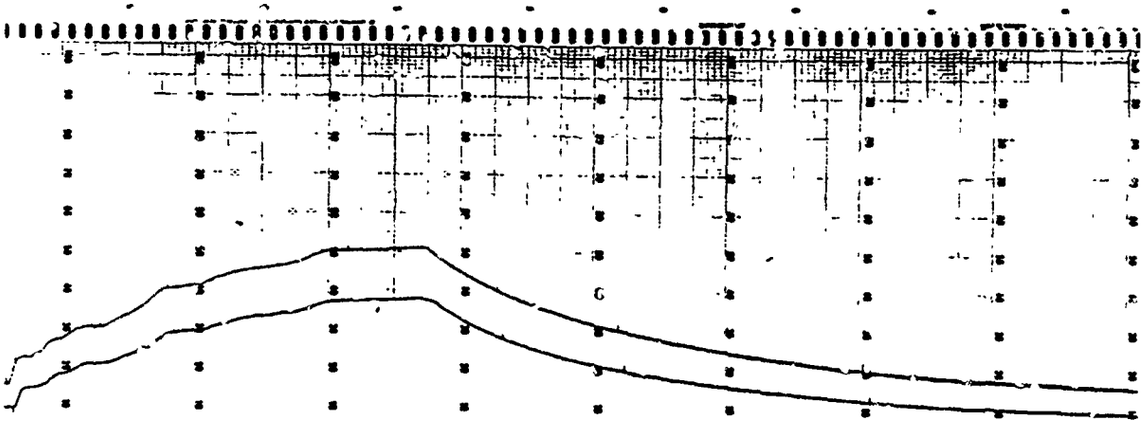


Test #5



Test #6





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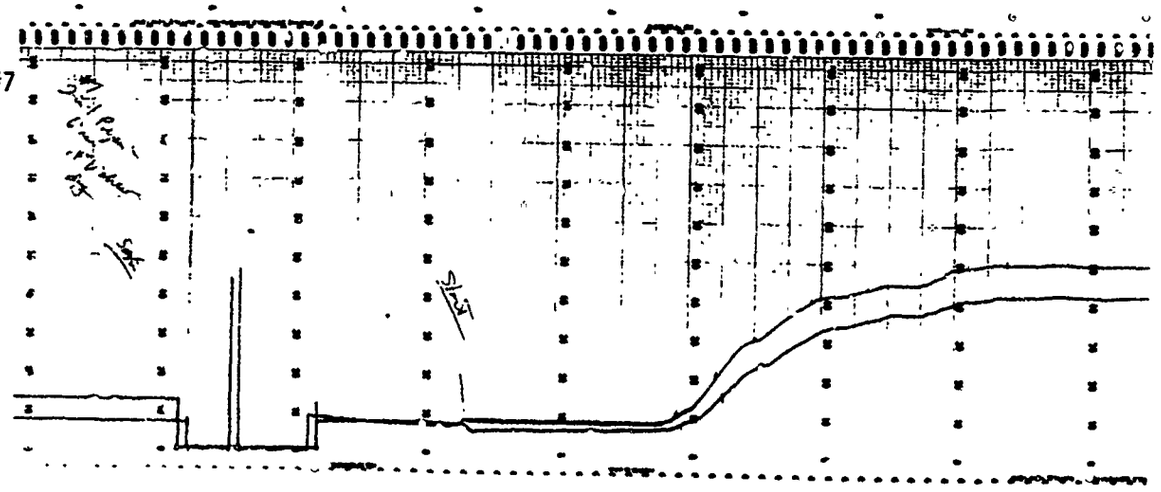
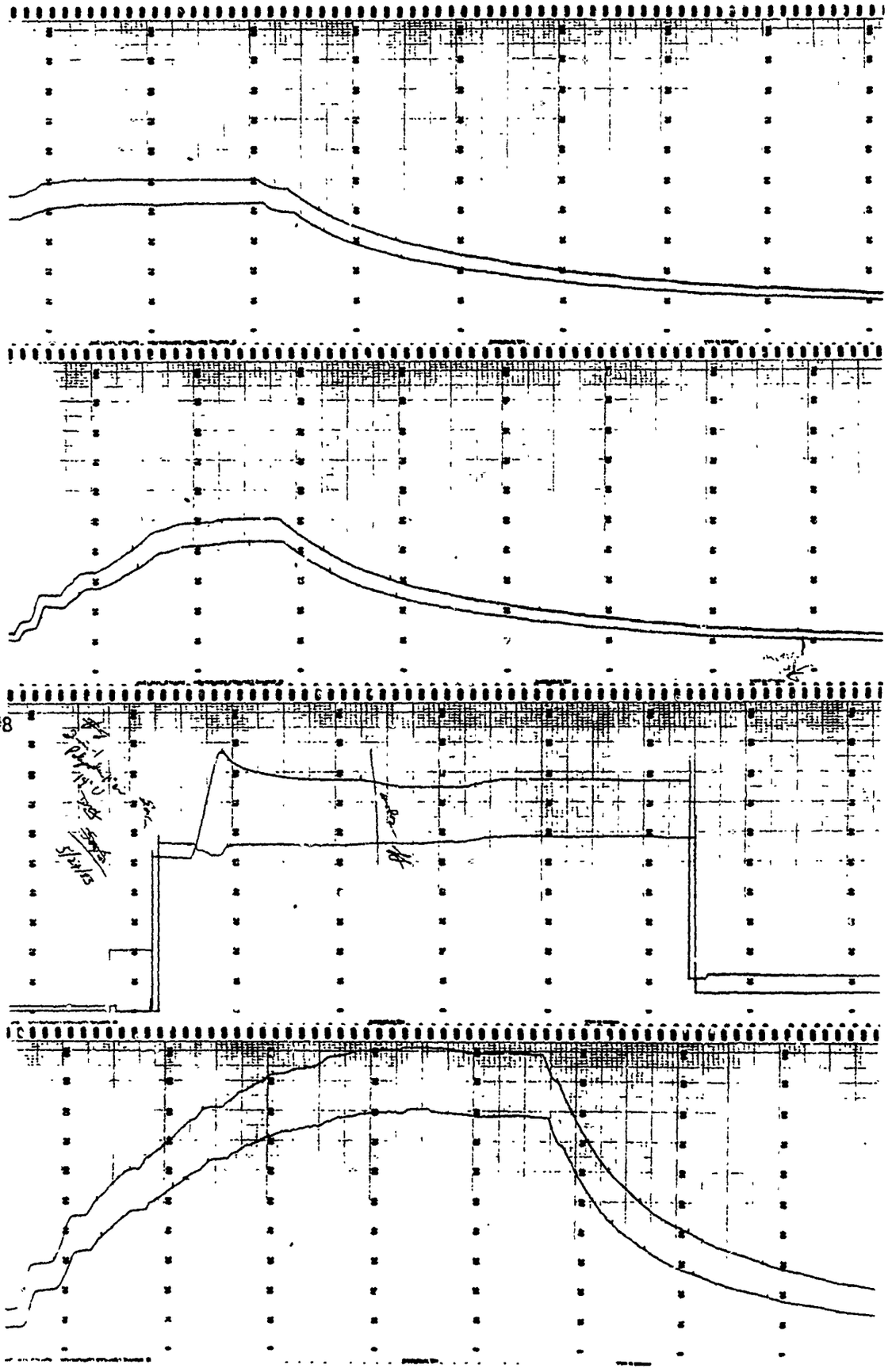
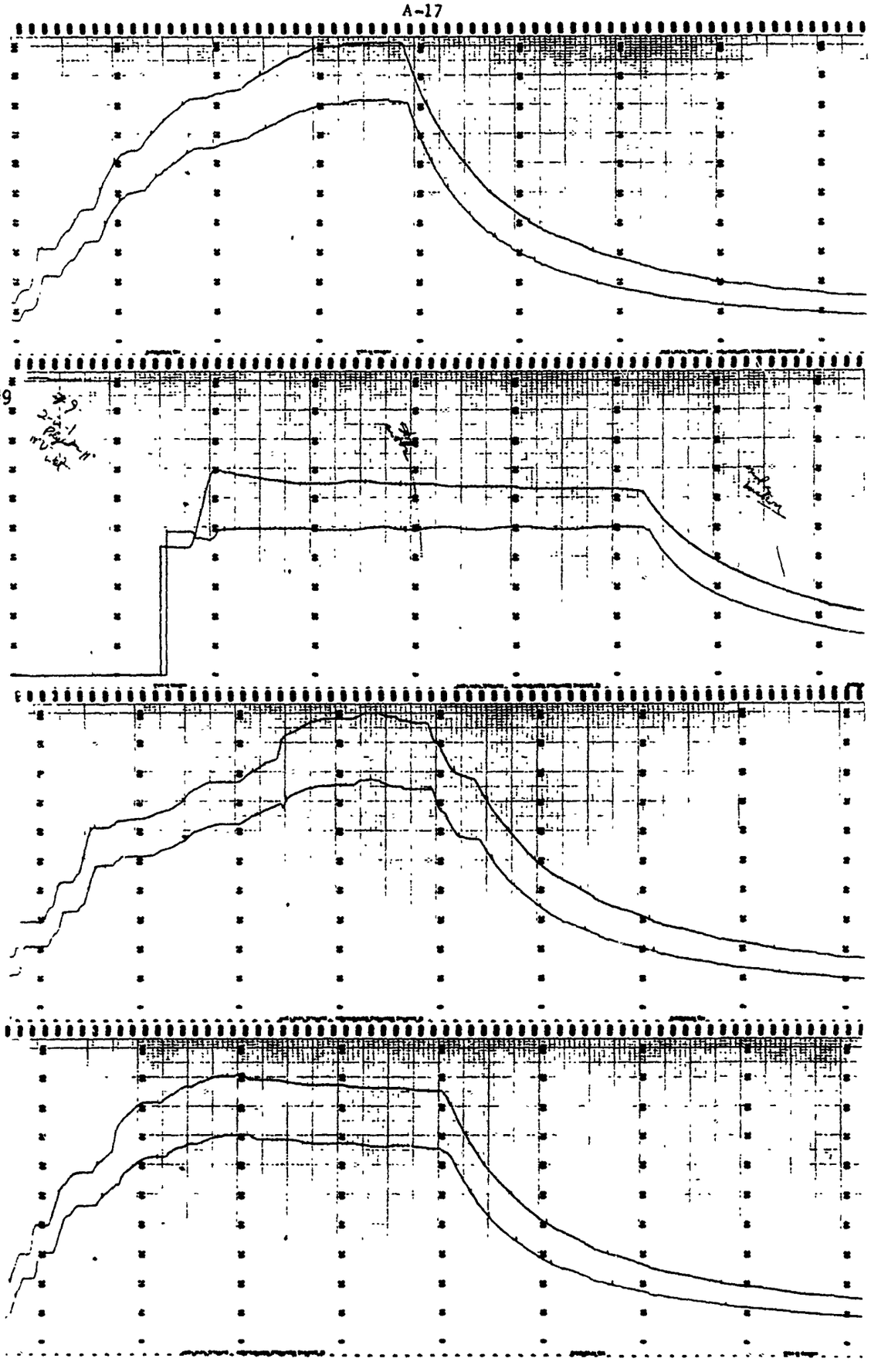




Test #8

Test #9



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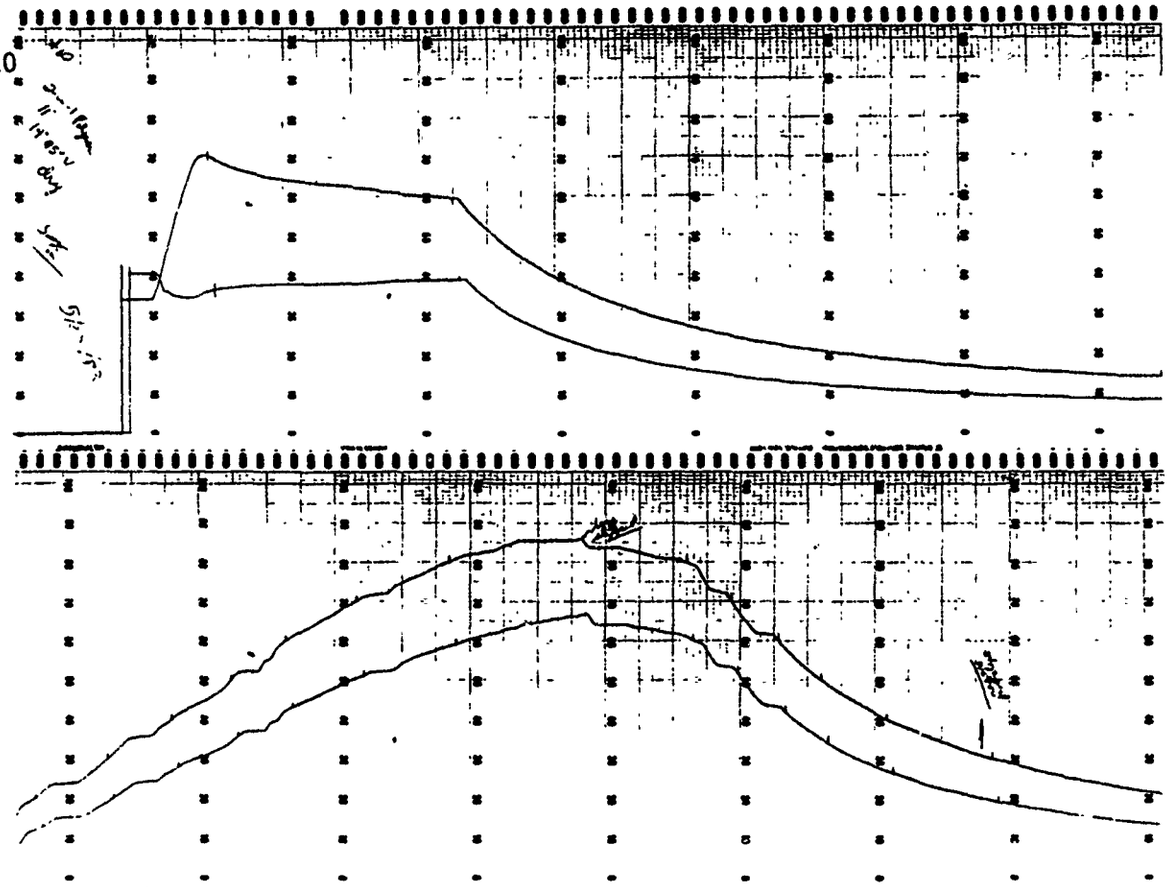
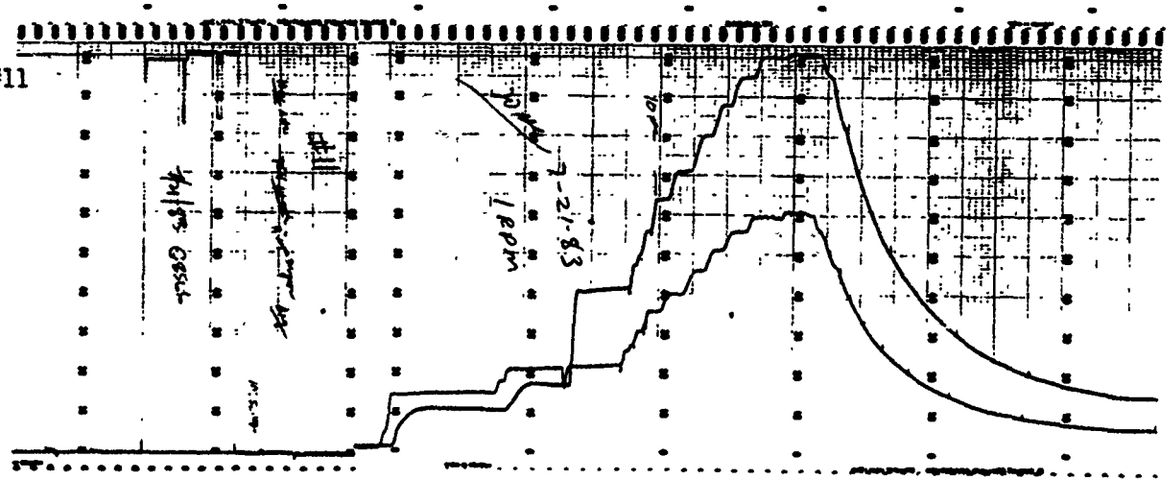
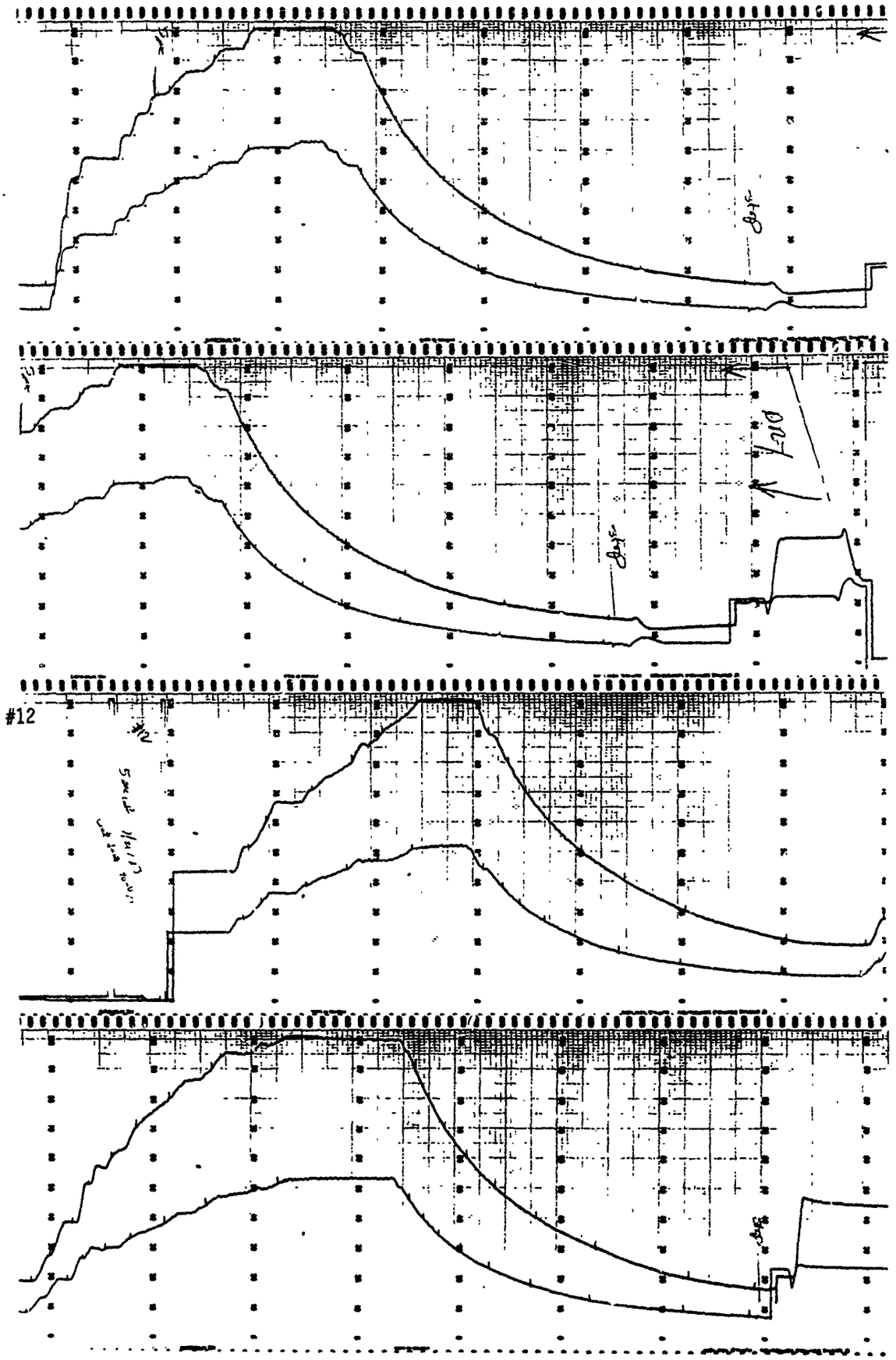


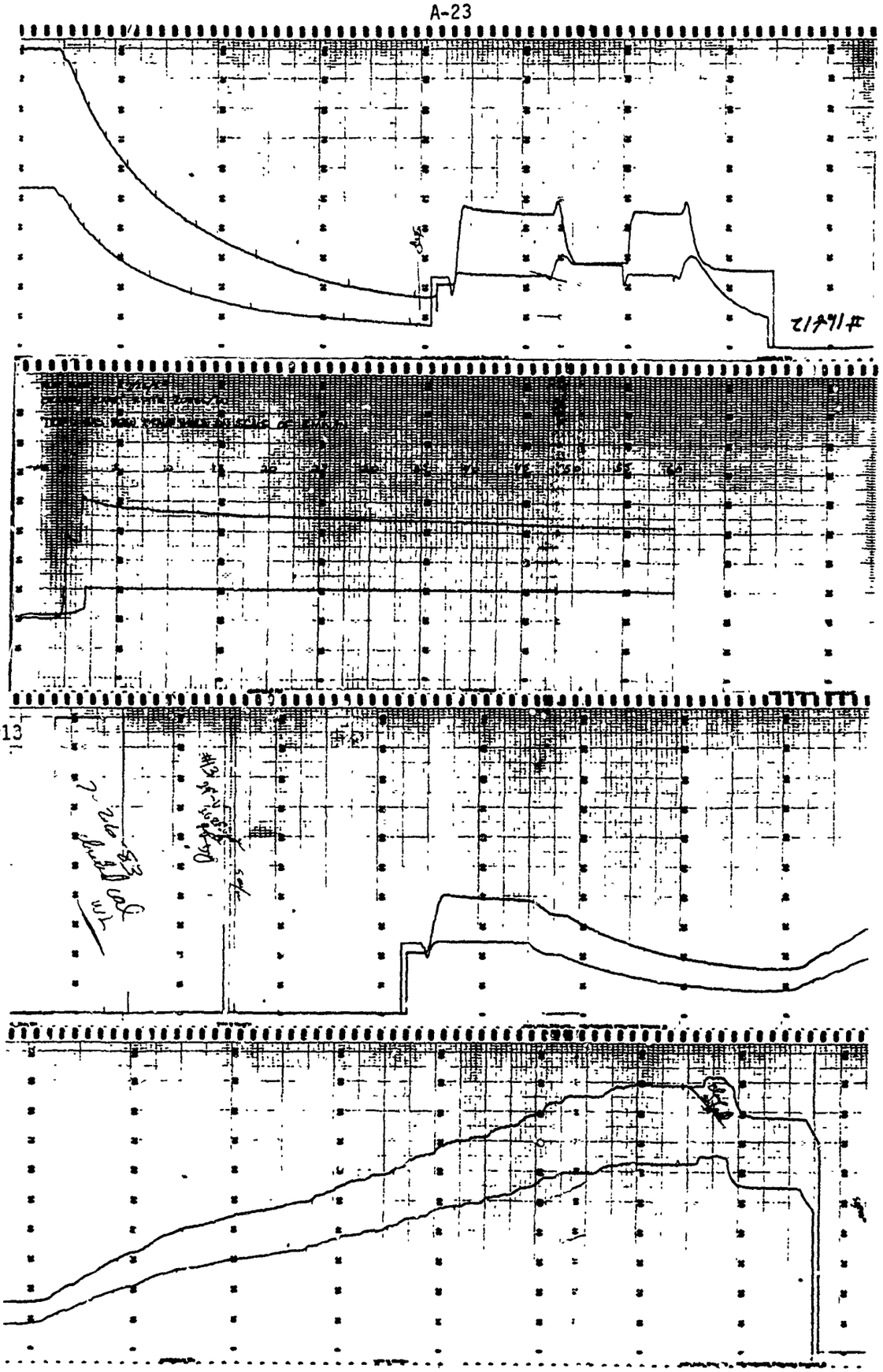
Test #11





Test #12

Test #13



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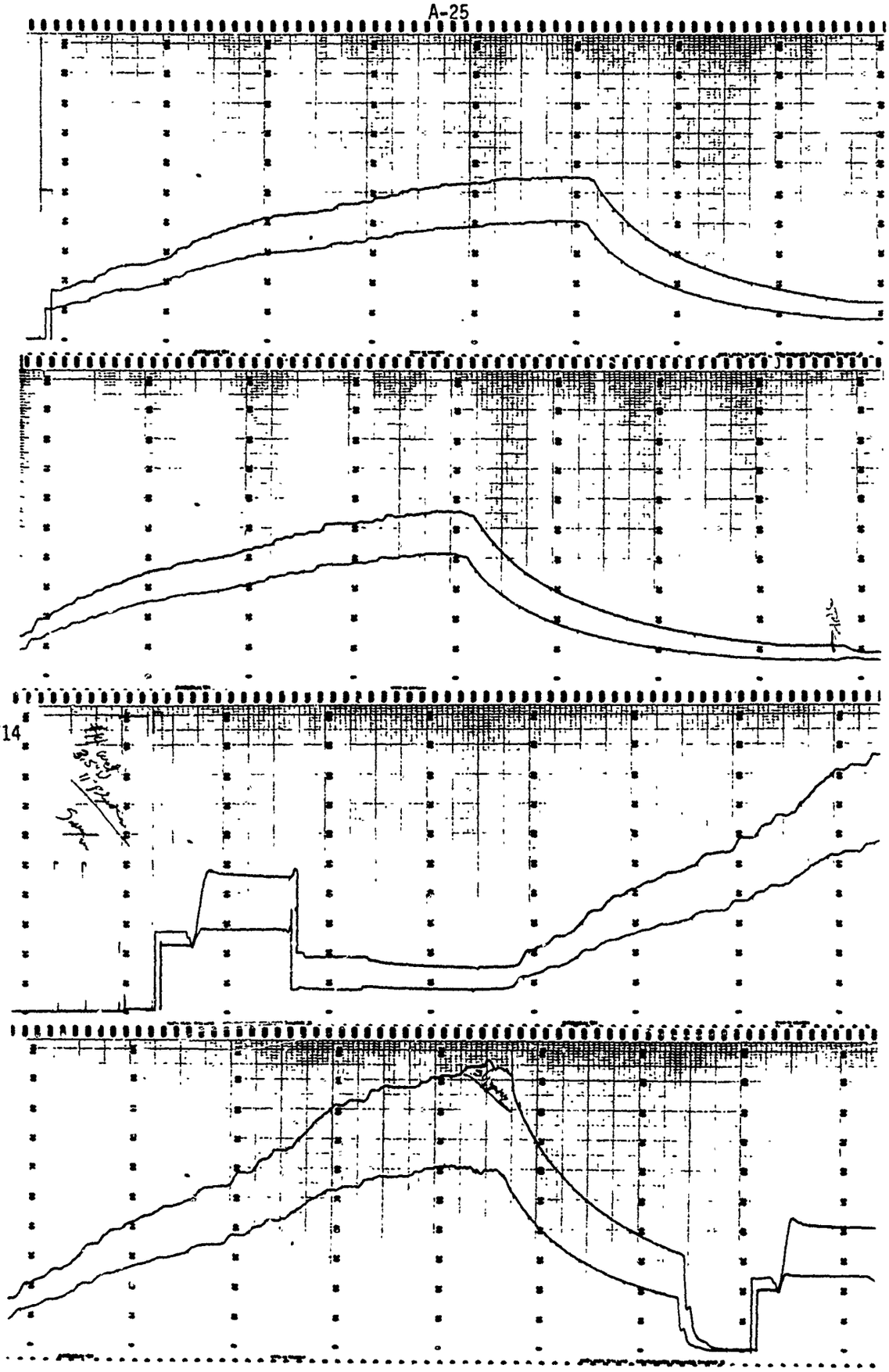
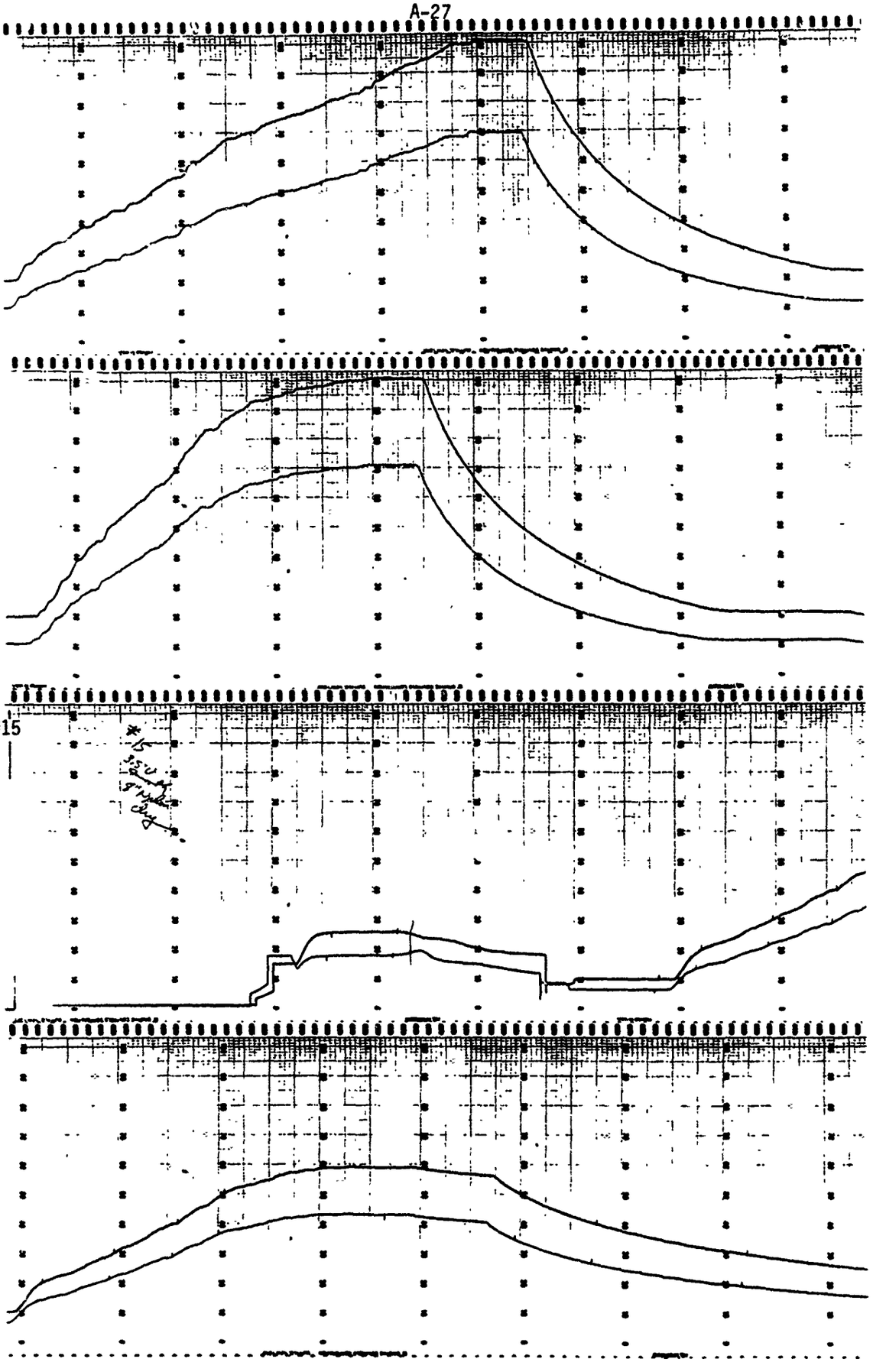
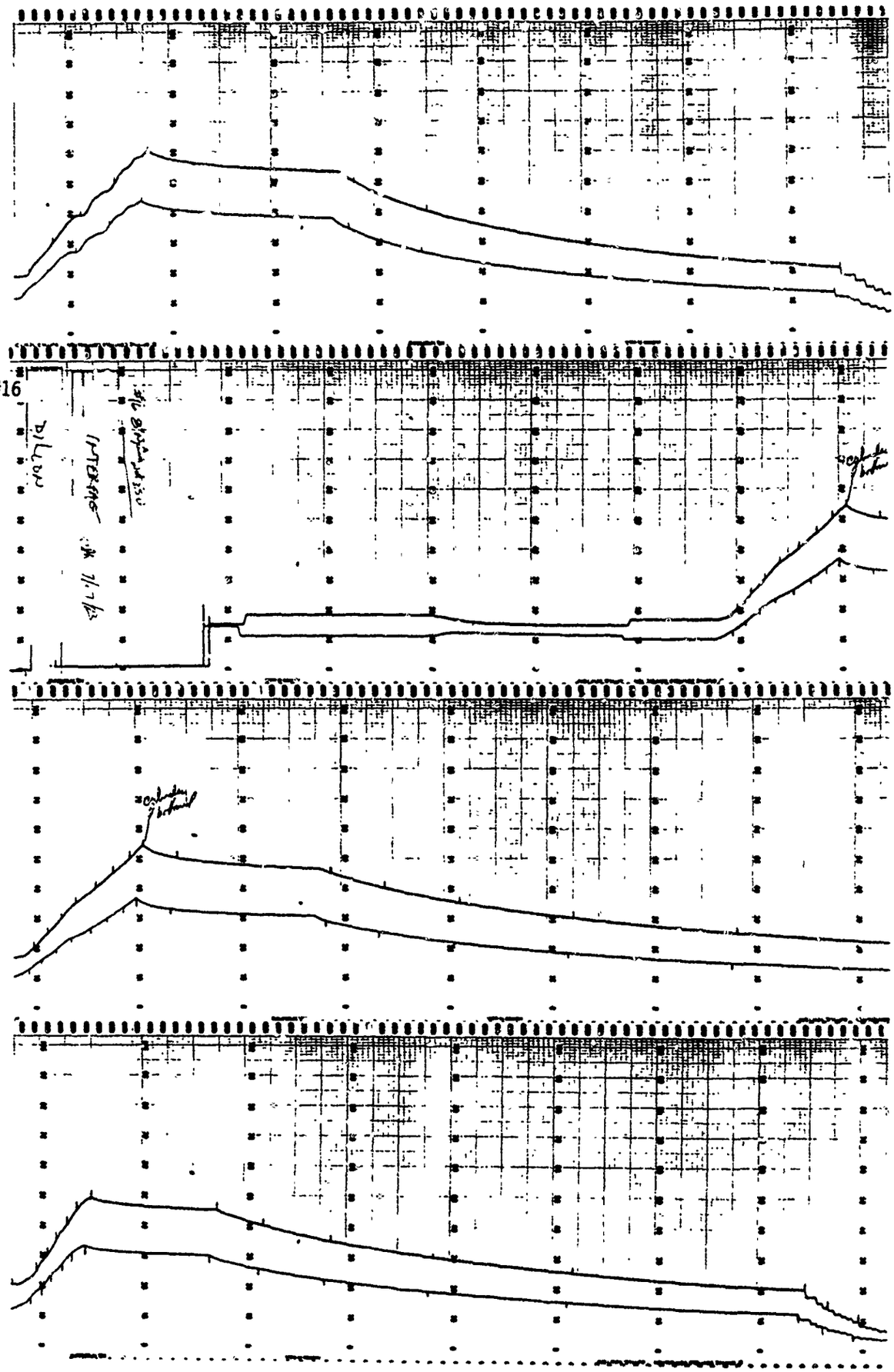




Test #15

Test #16



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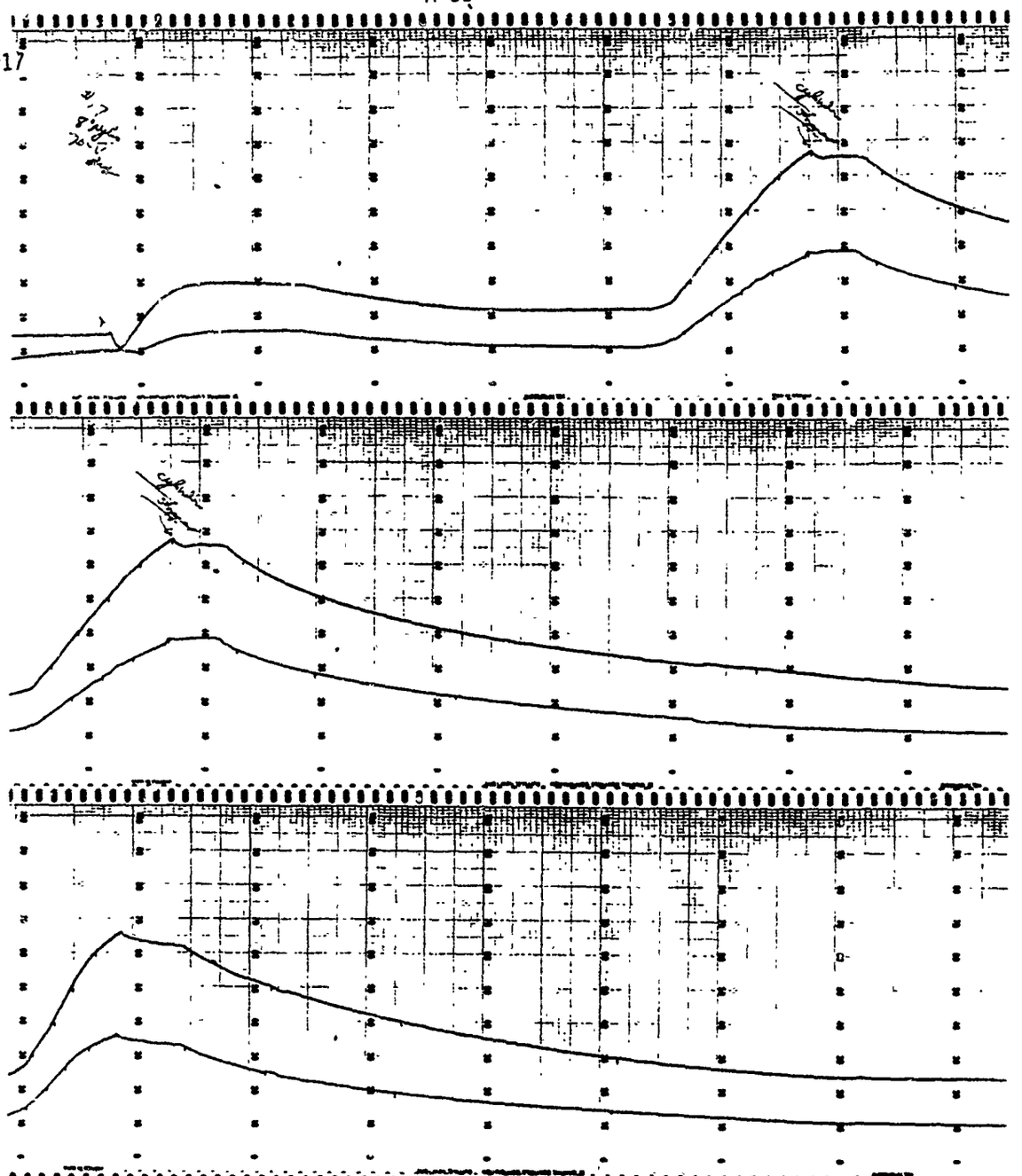

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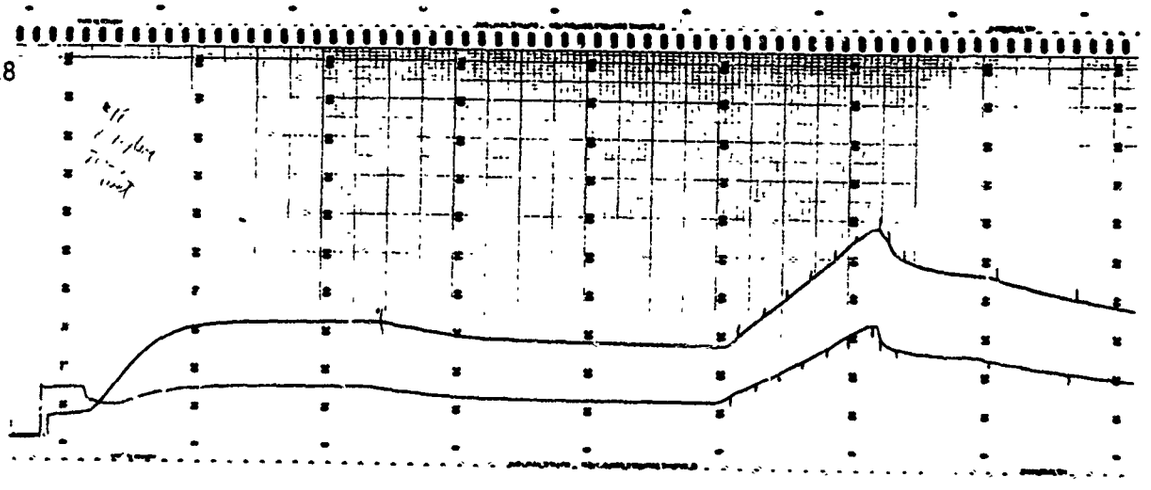

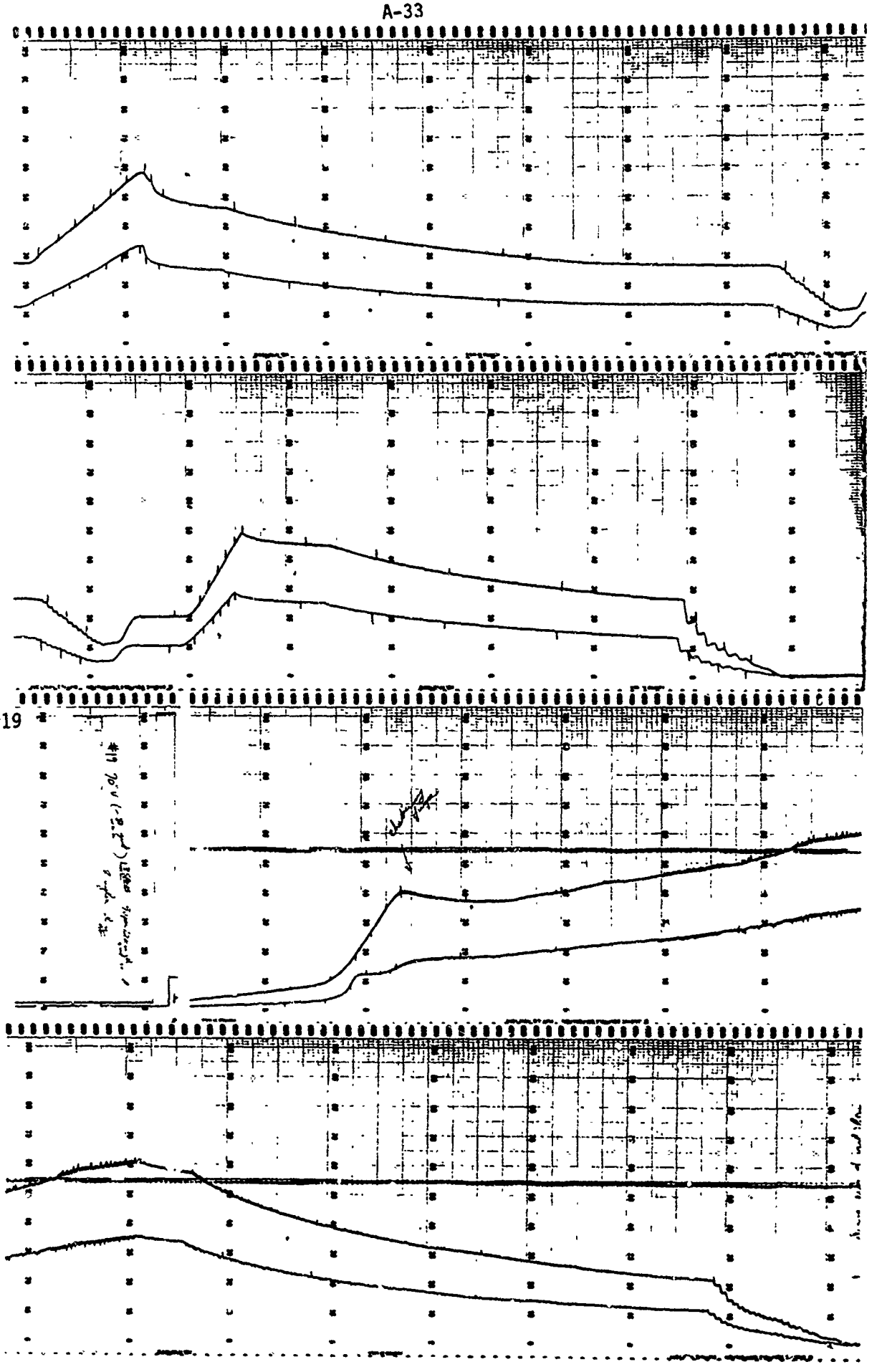

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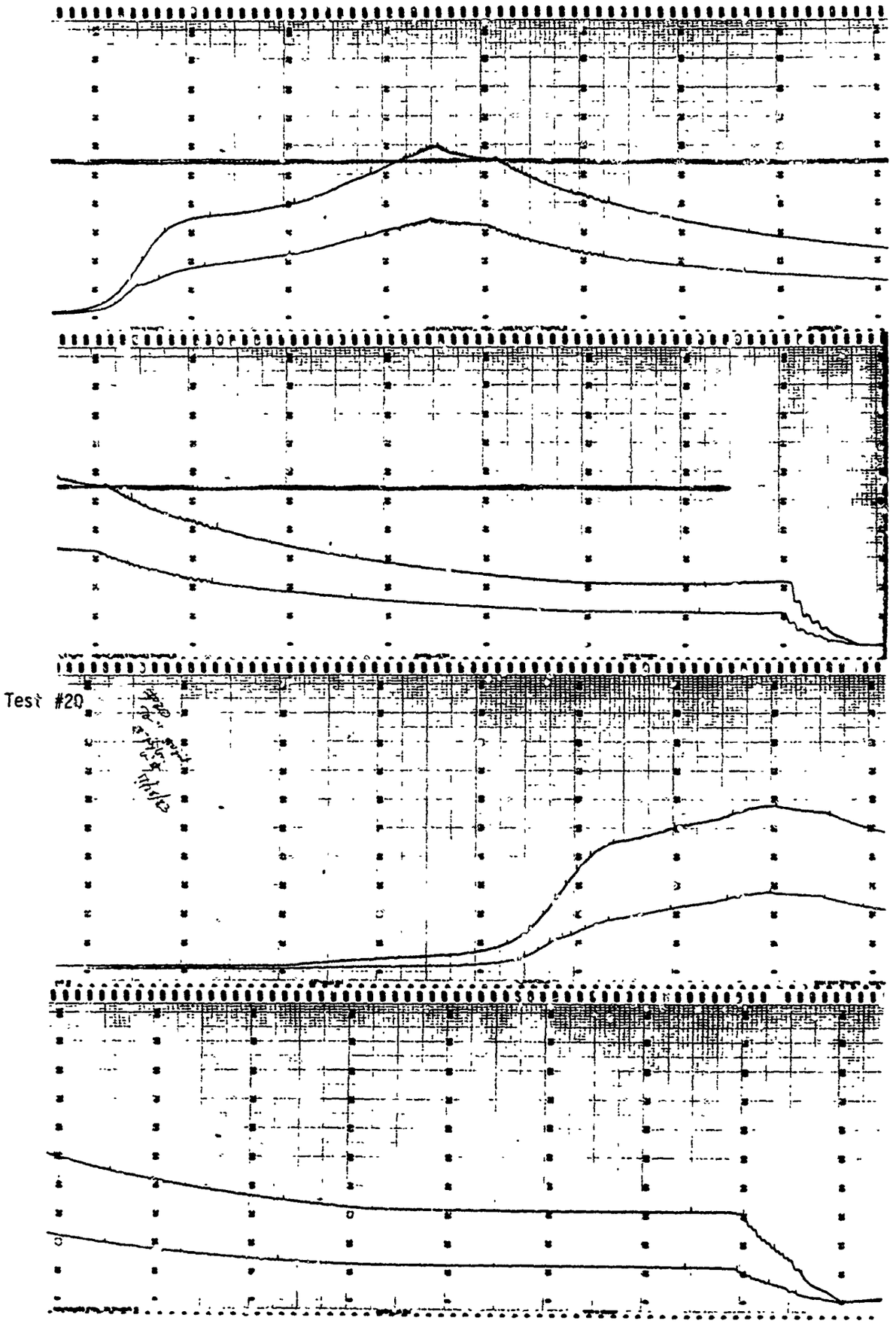

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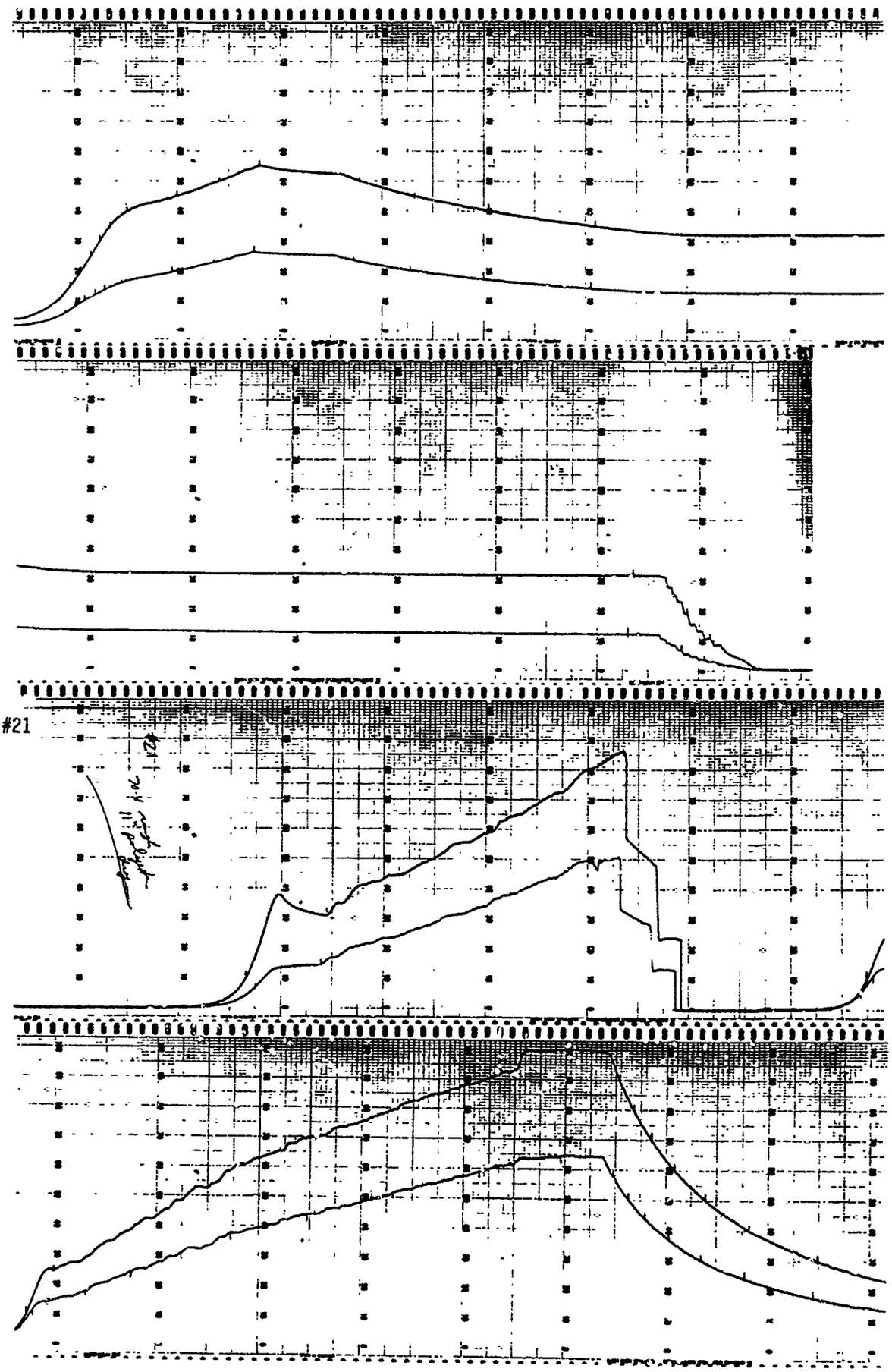
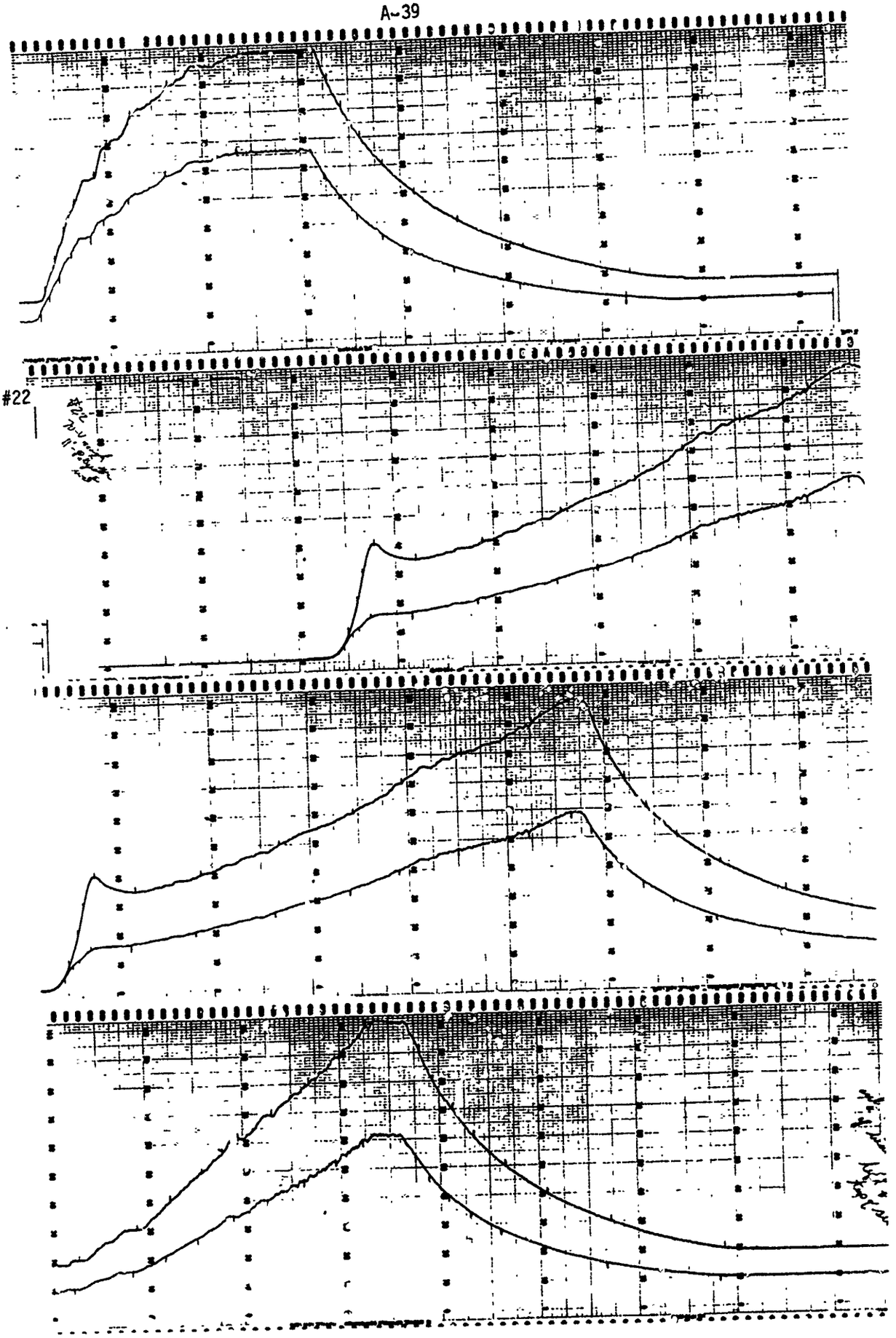
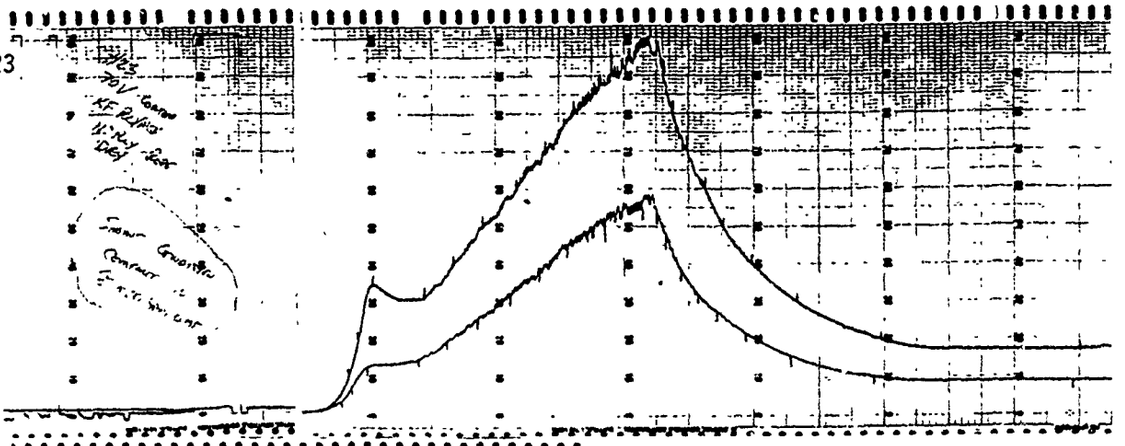


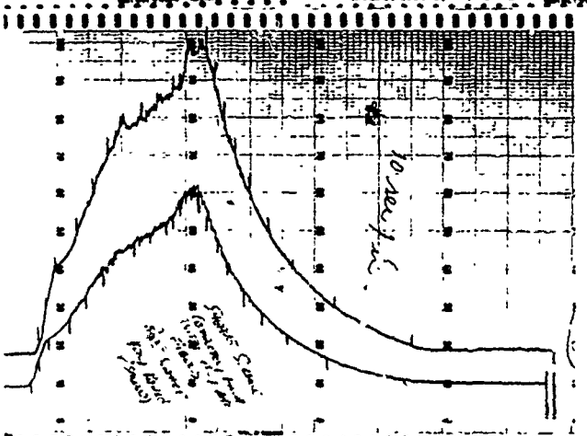
Test #21

Test #22



Test 23





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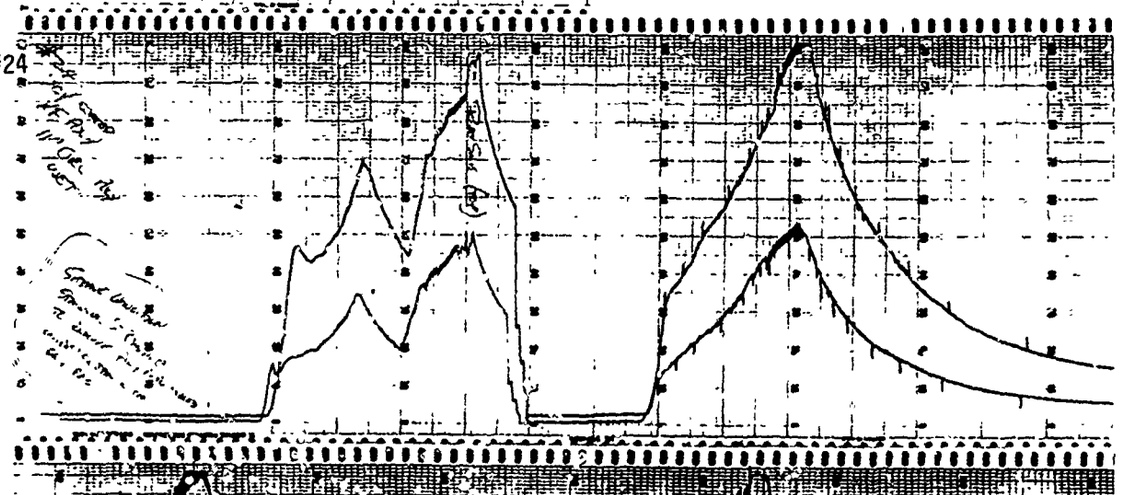

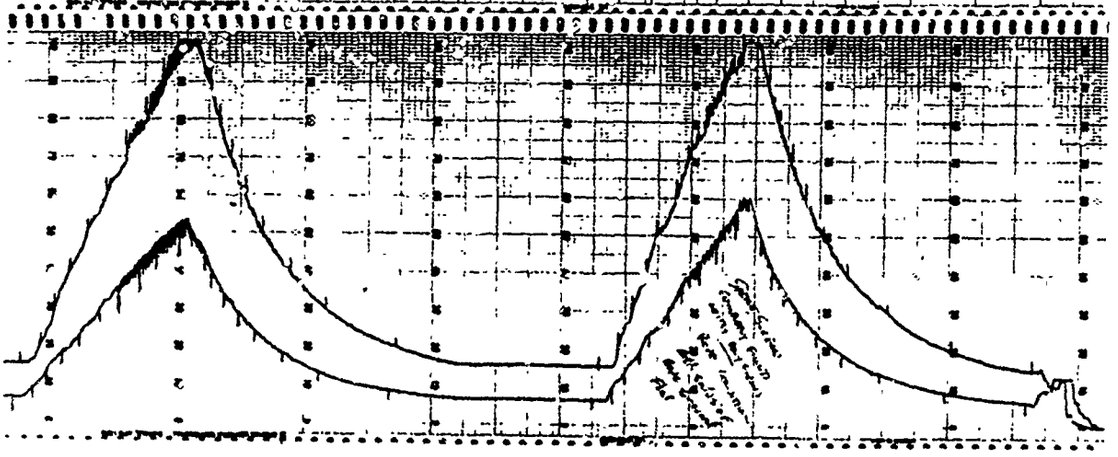

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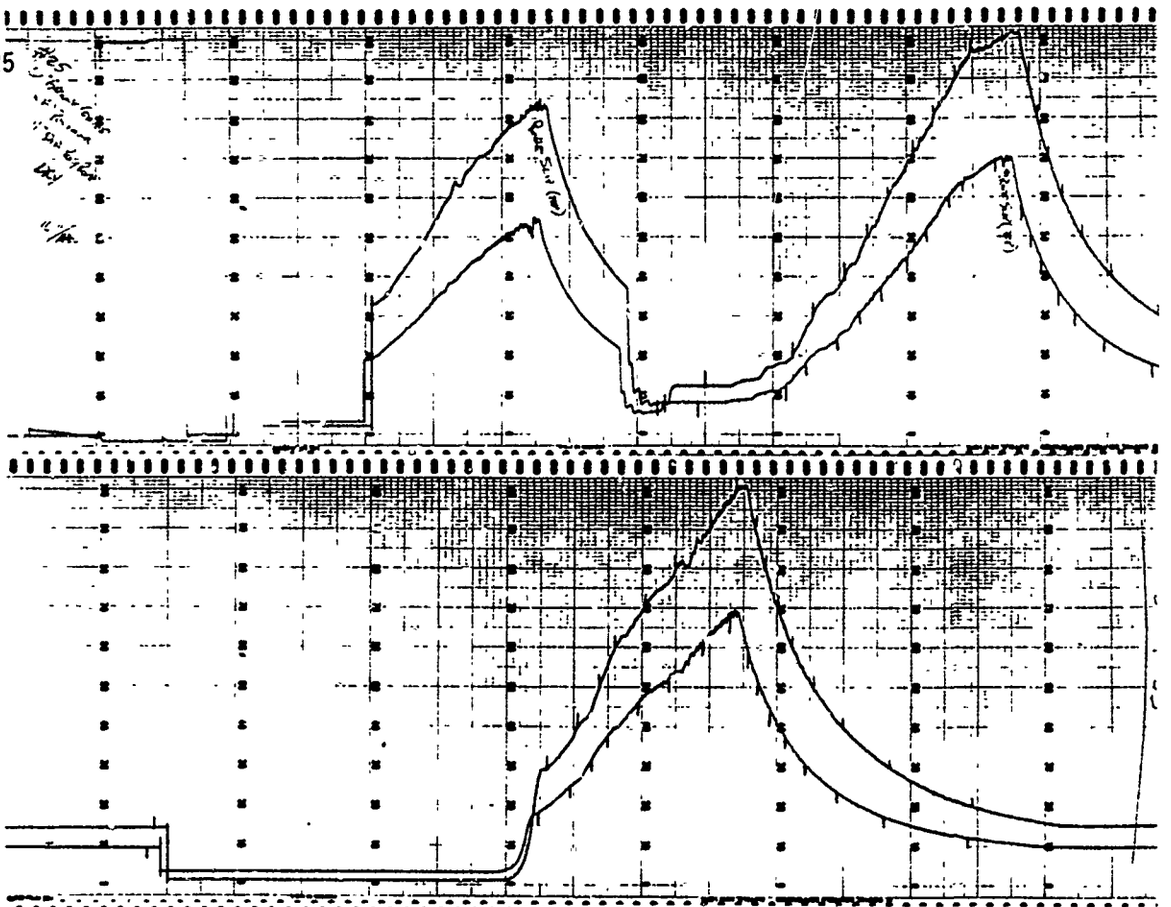

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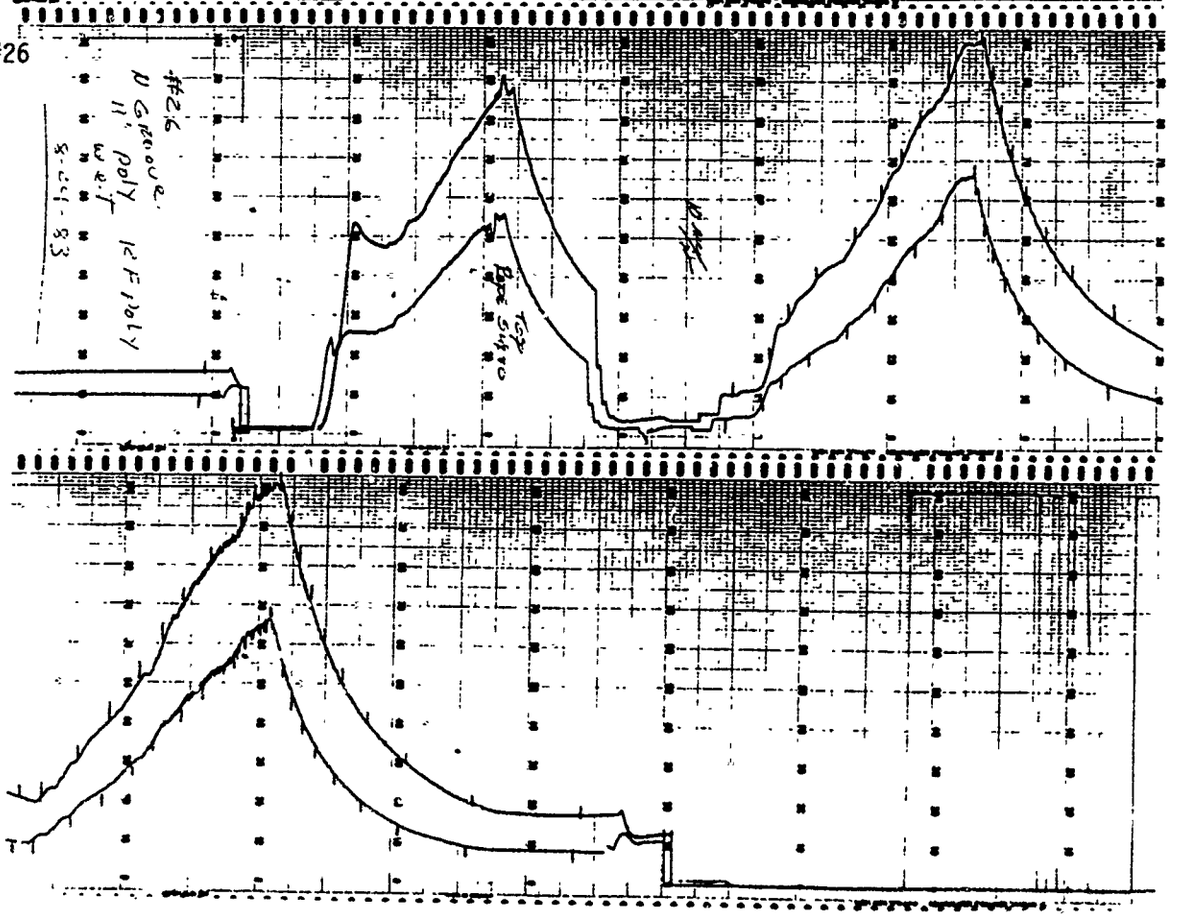

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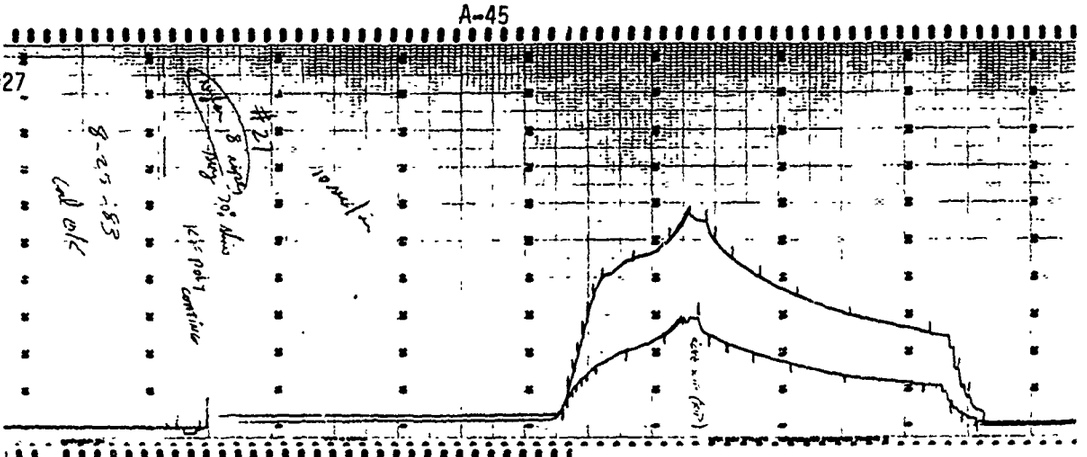
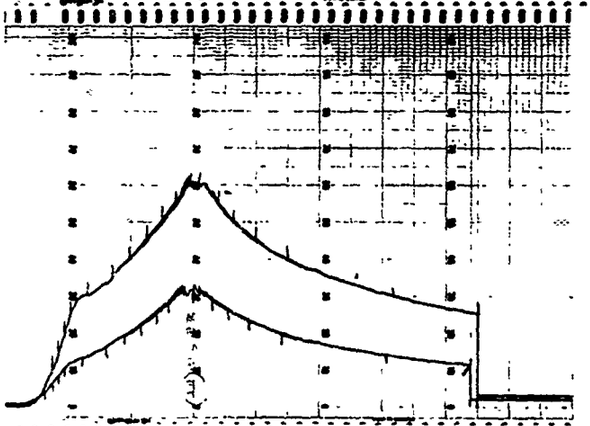
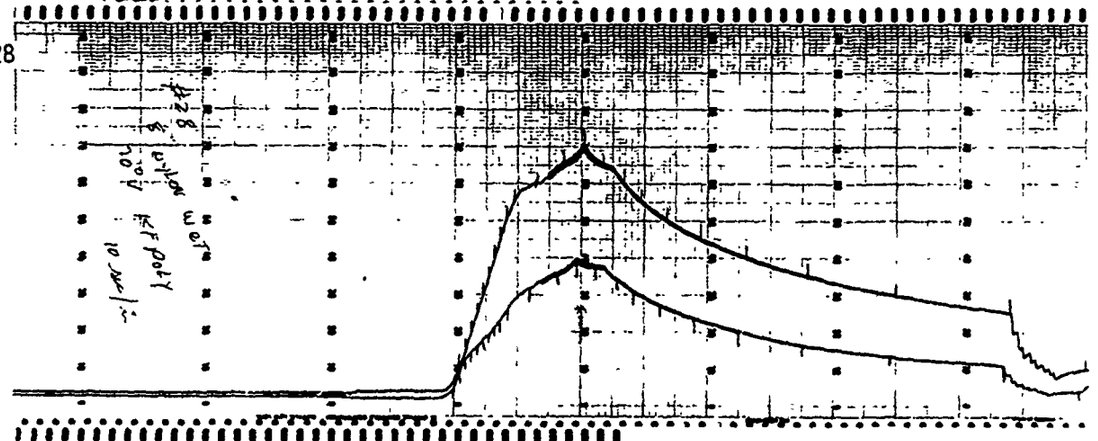
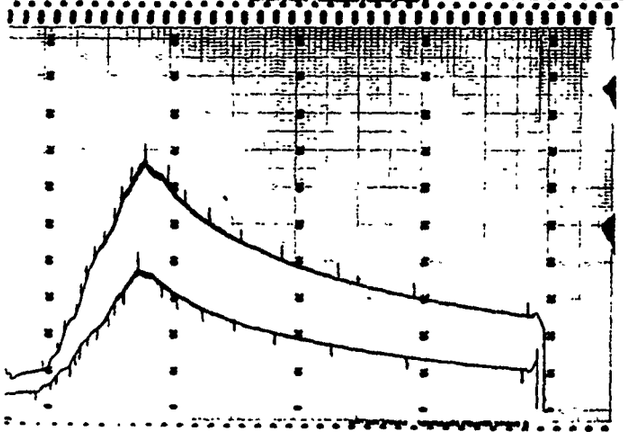


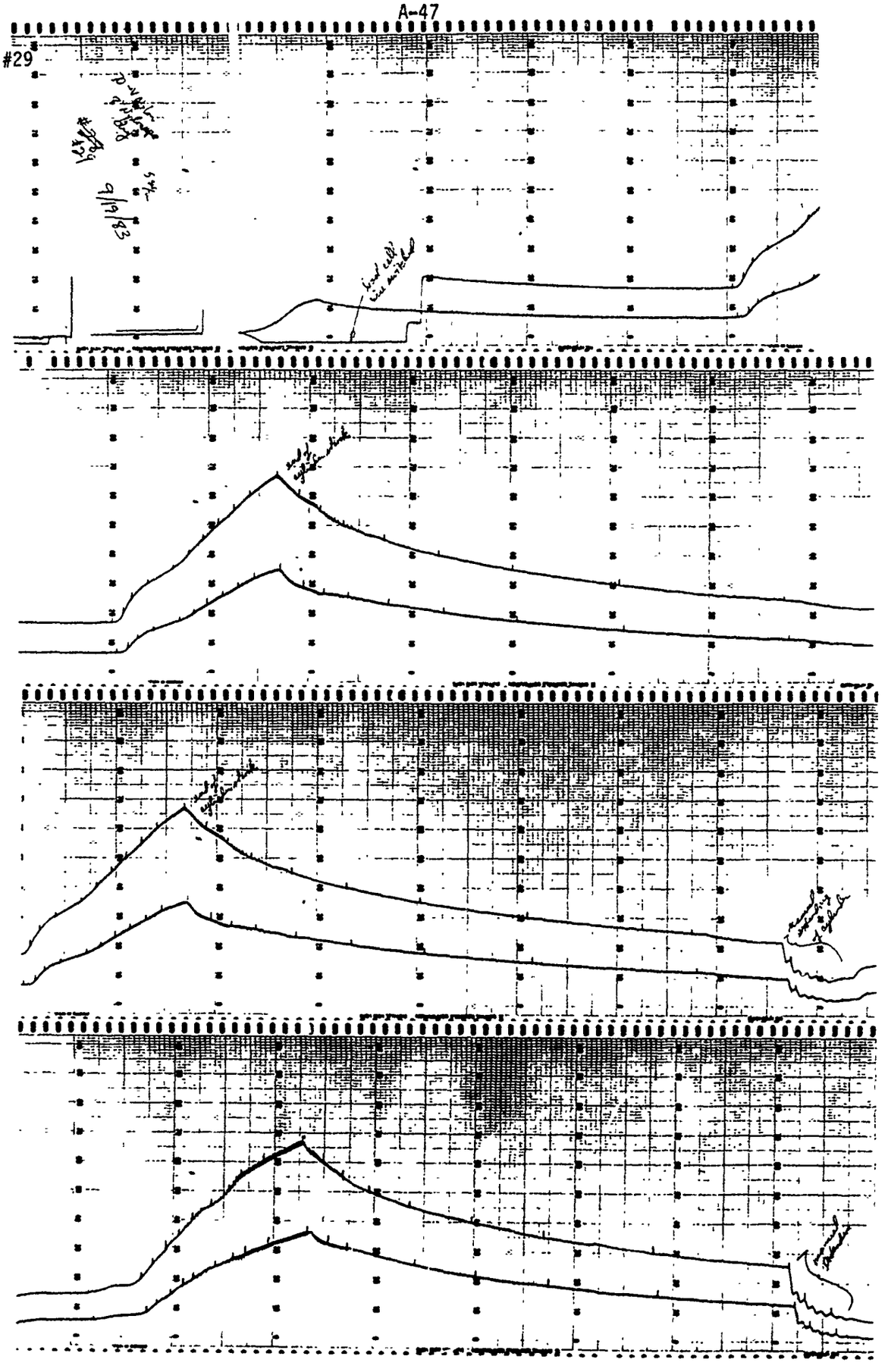


Test #28

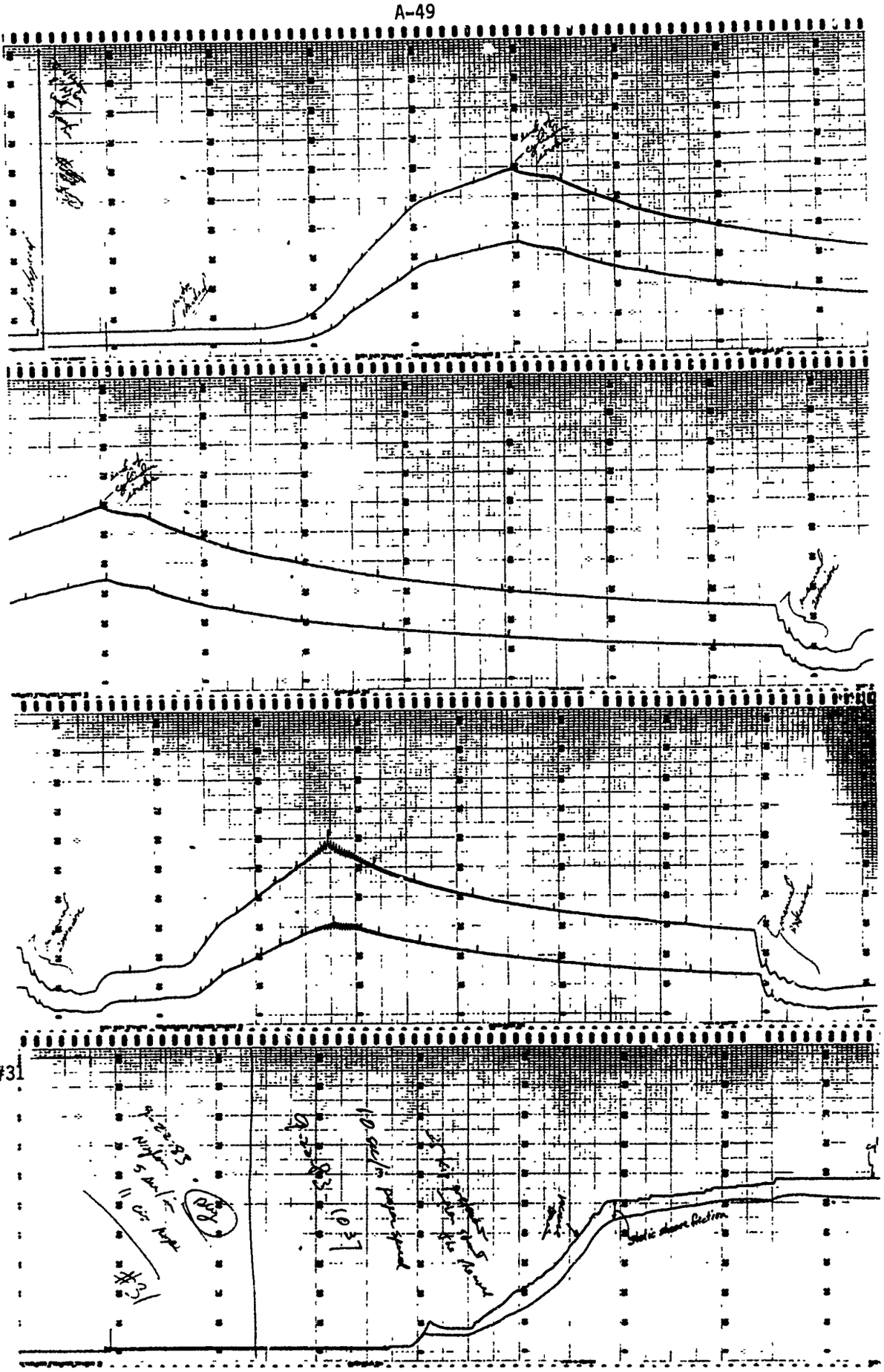




Test #29



Test #30



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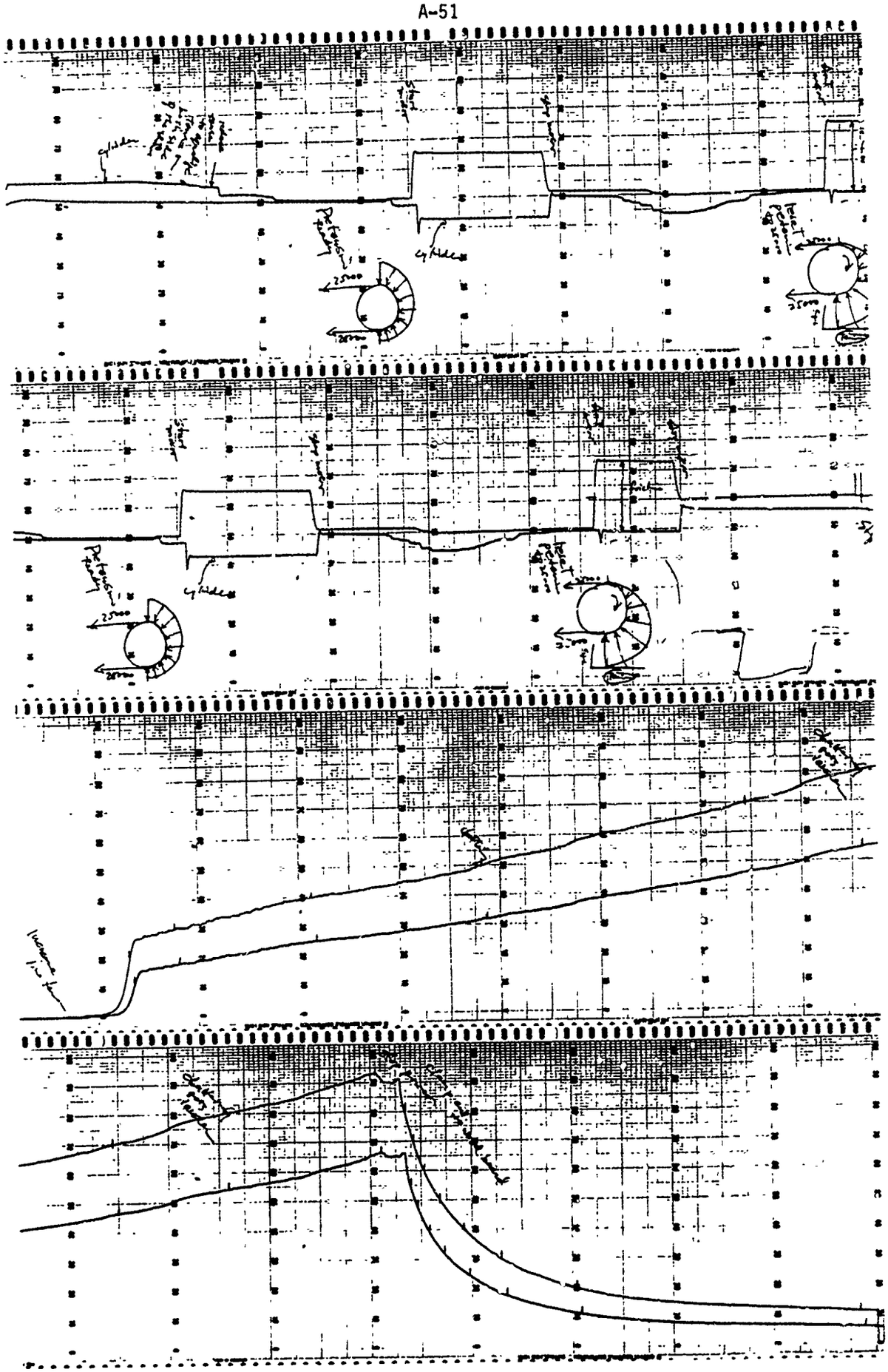

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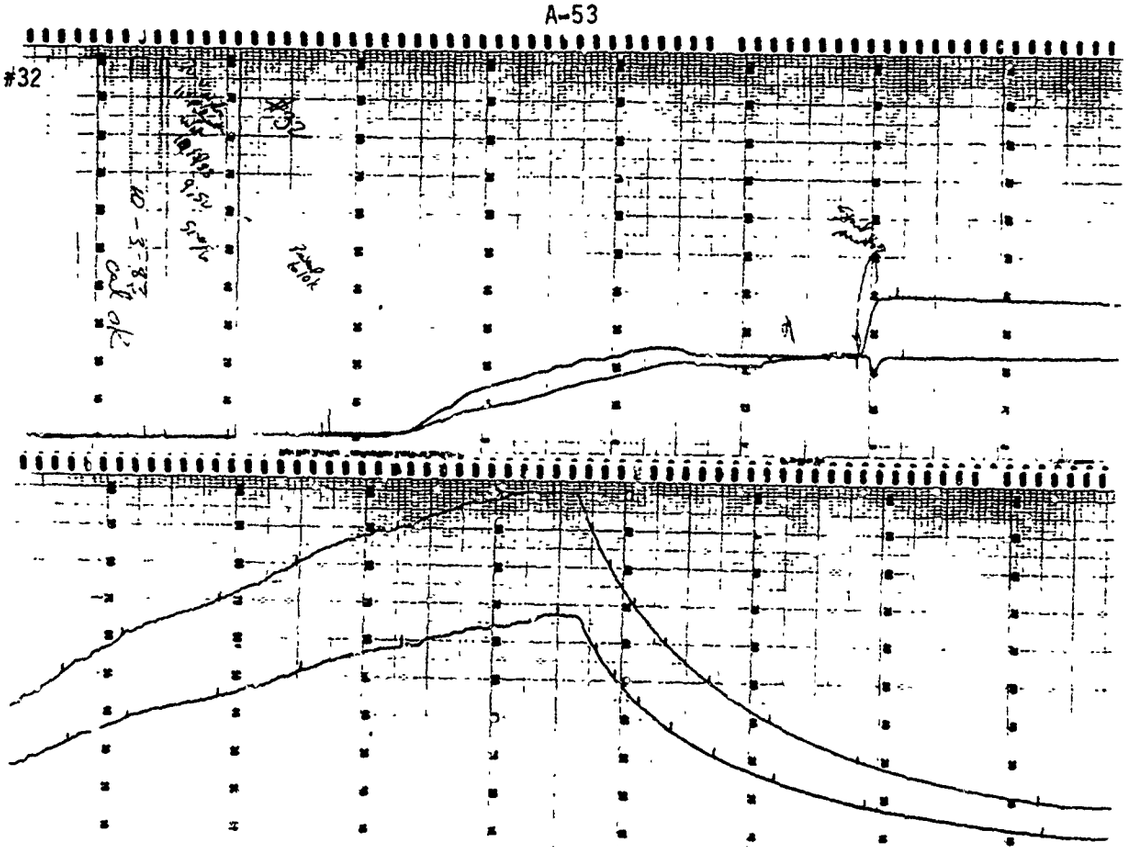

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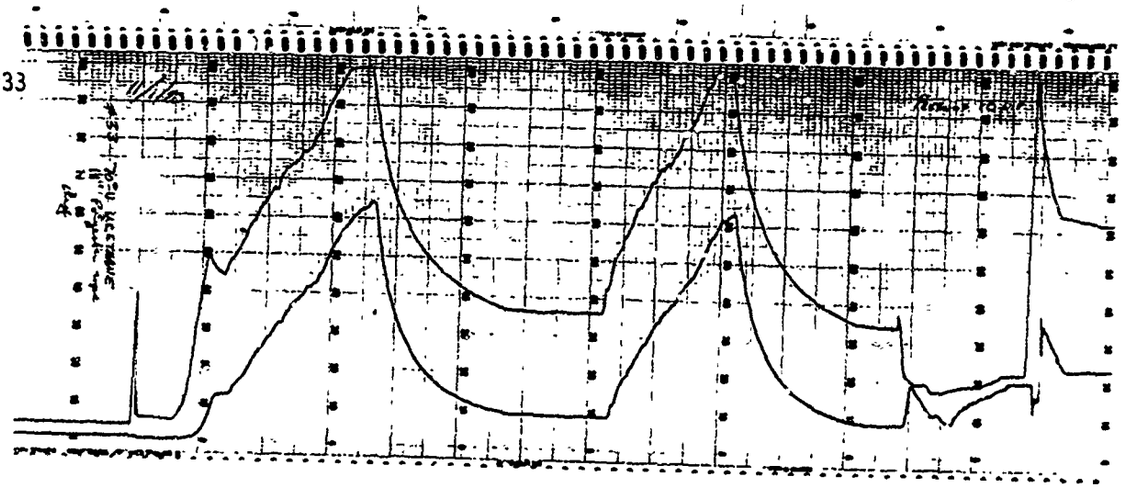
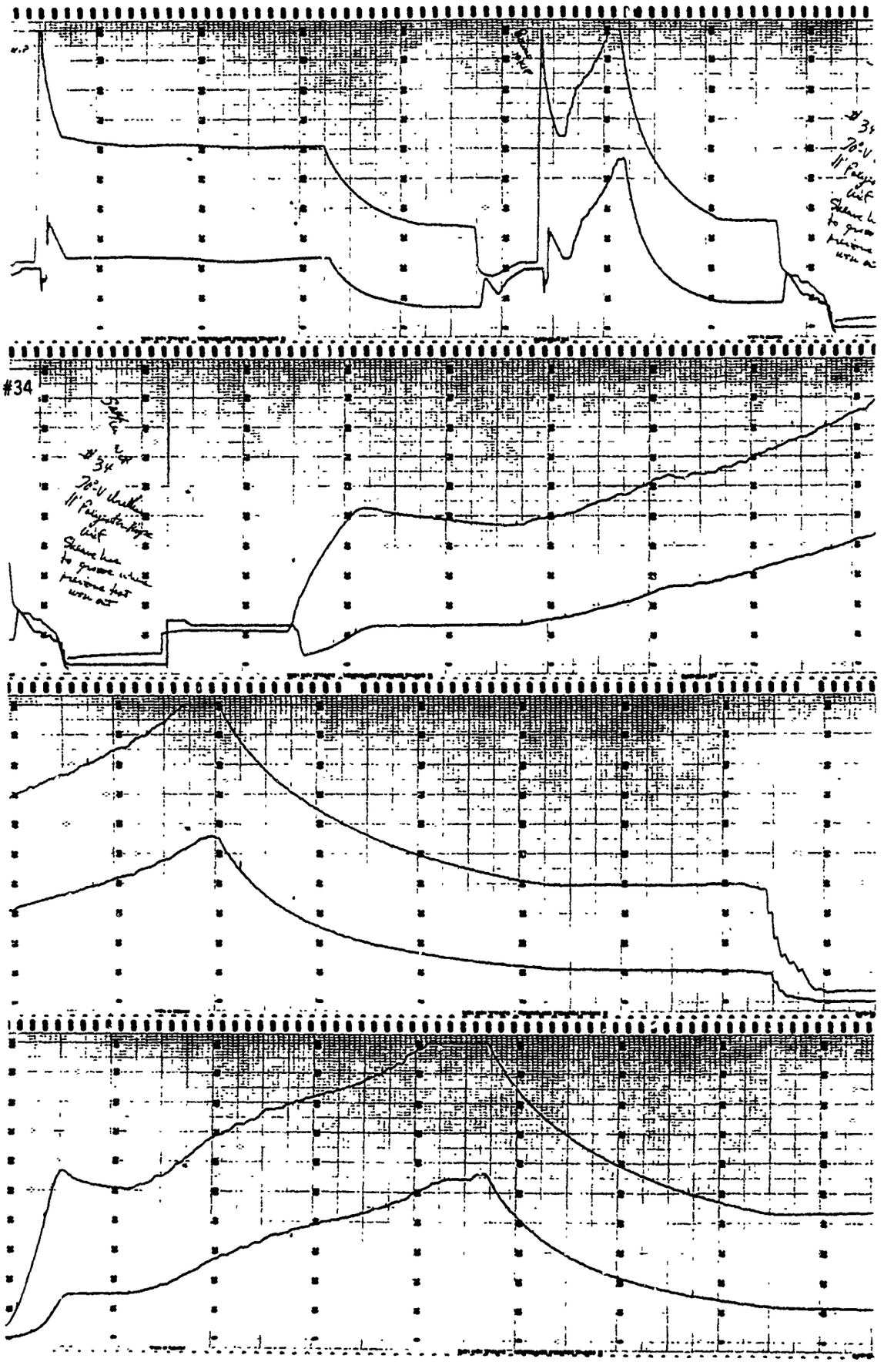
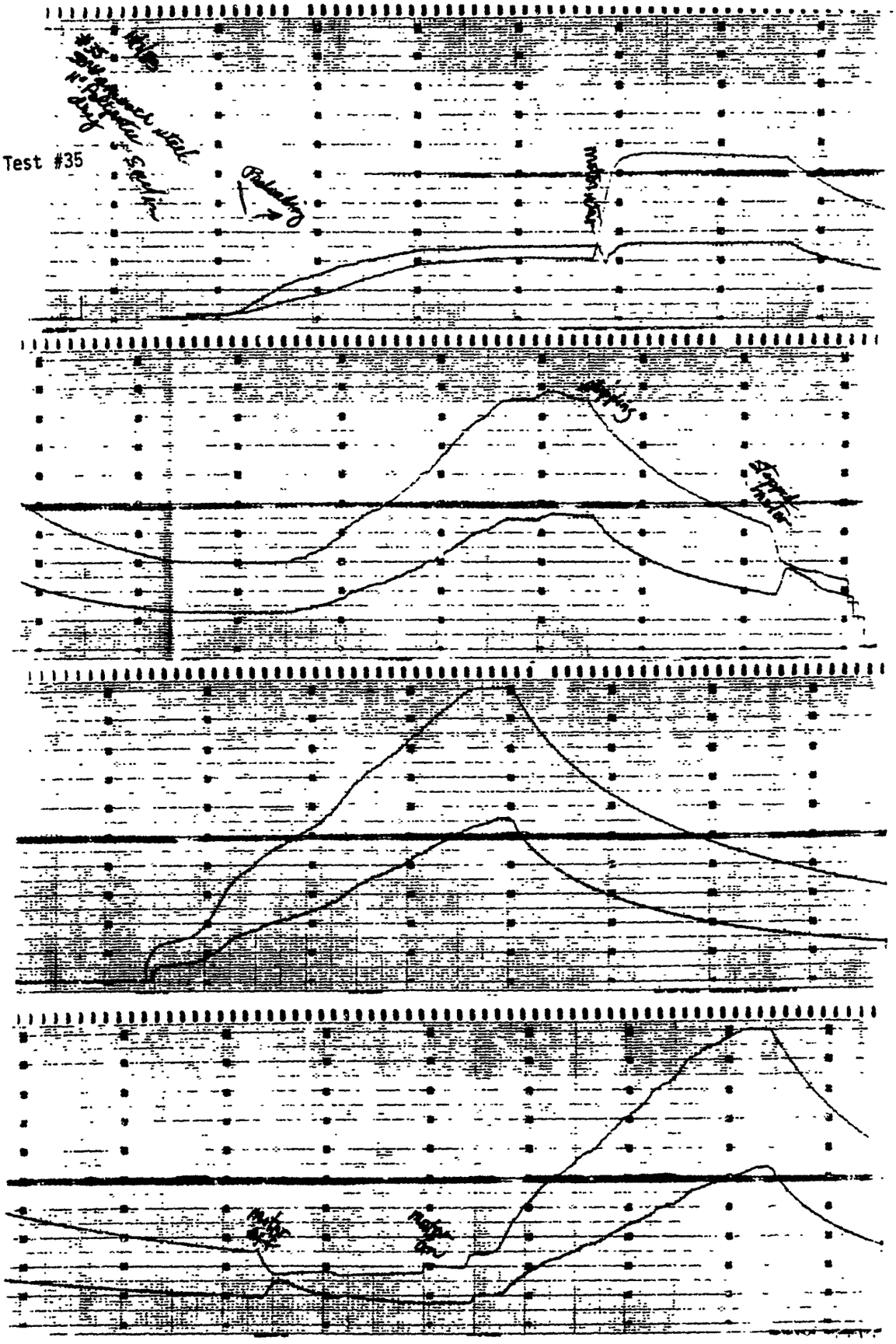
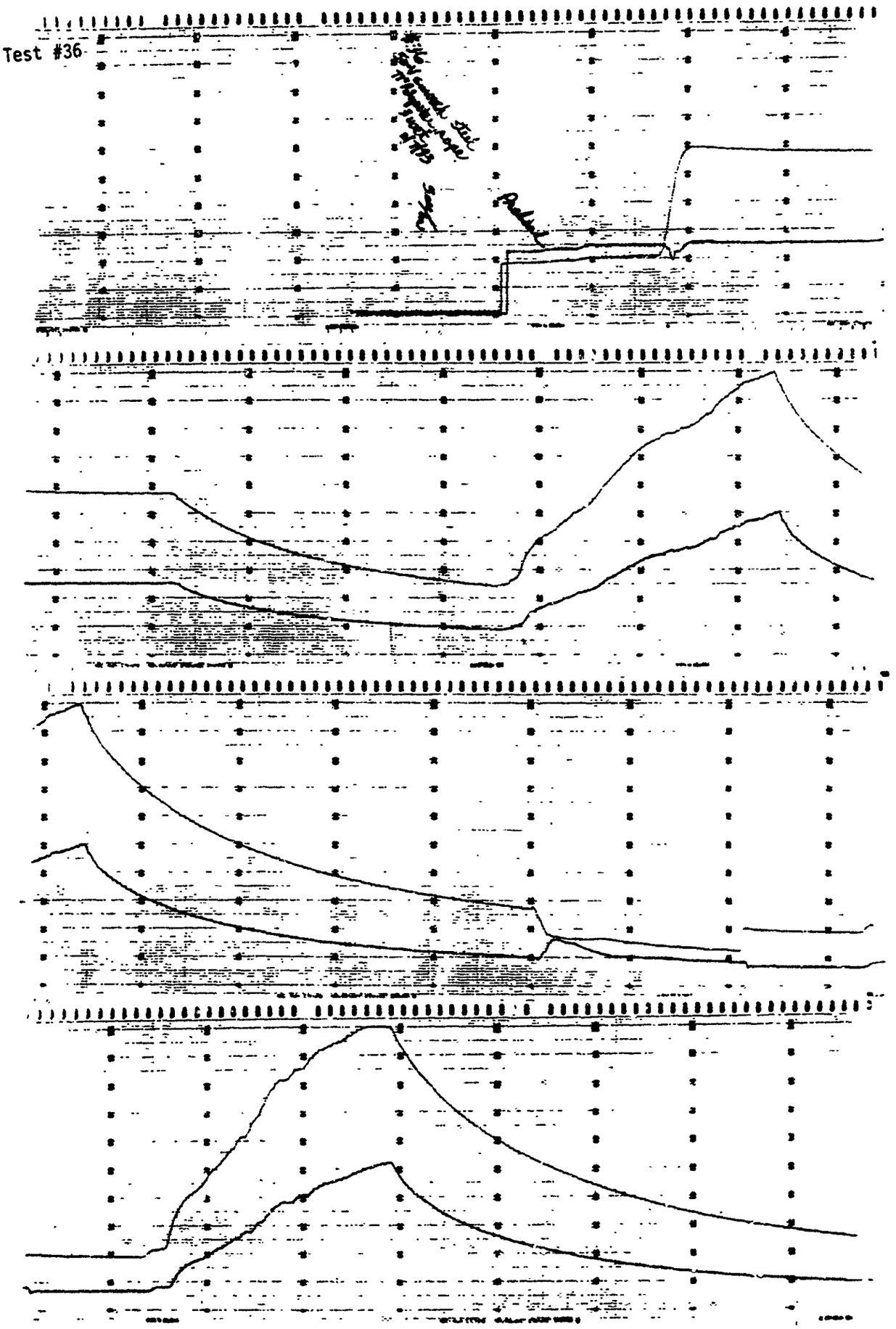


Test #34

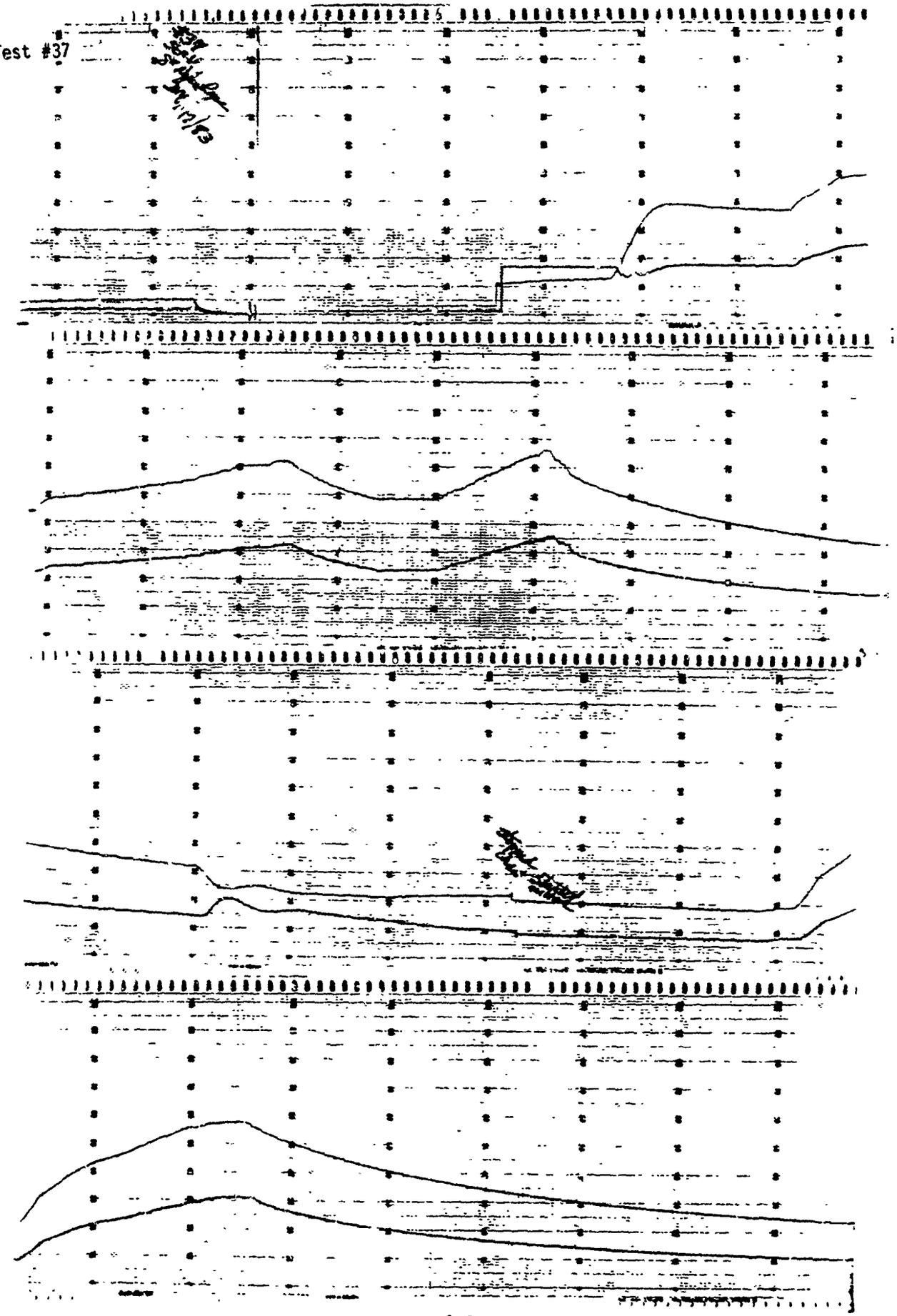


Test #35

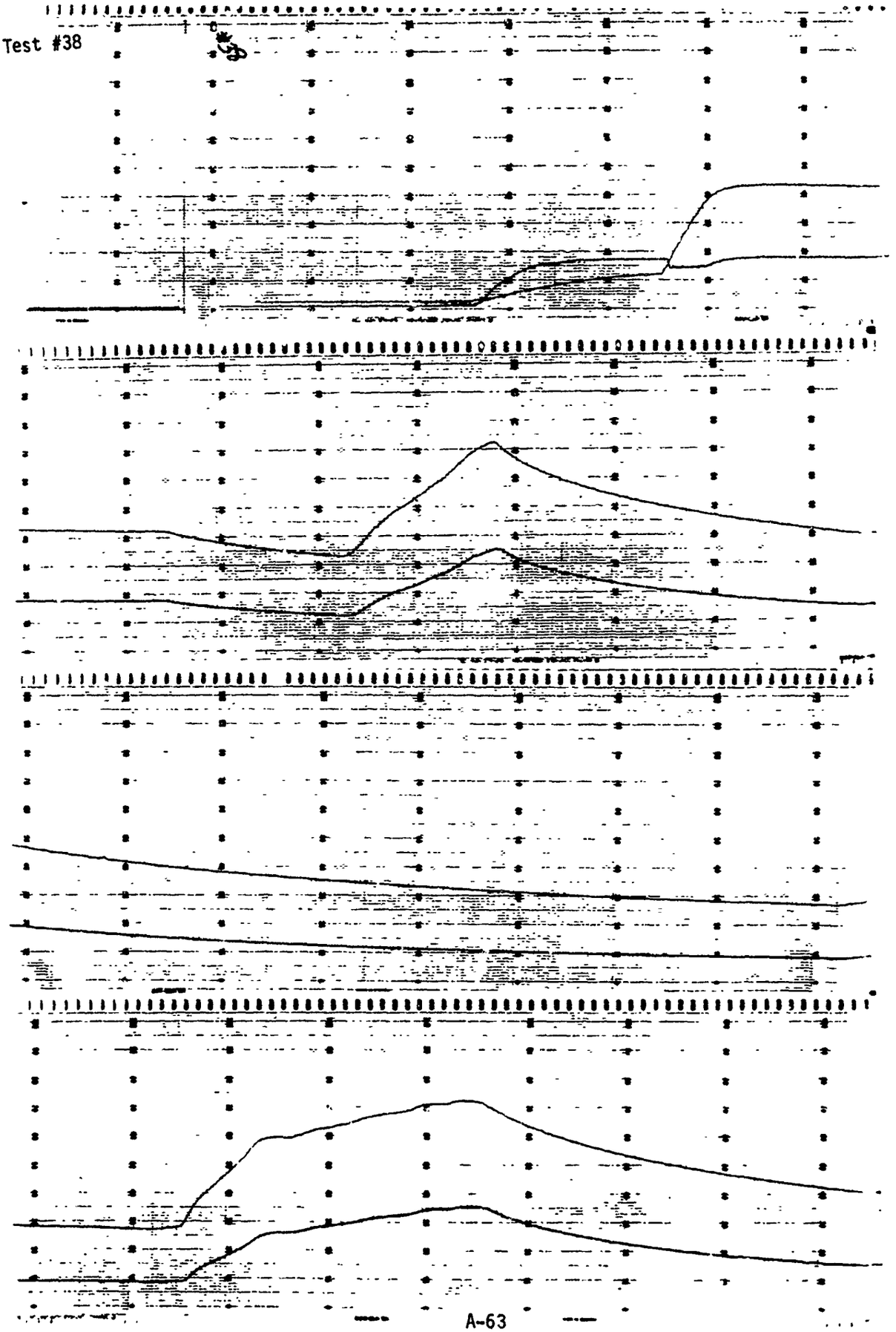



Test #36

Test #37

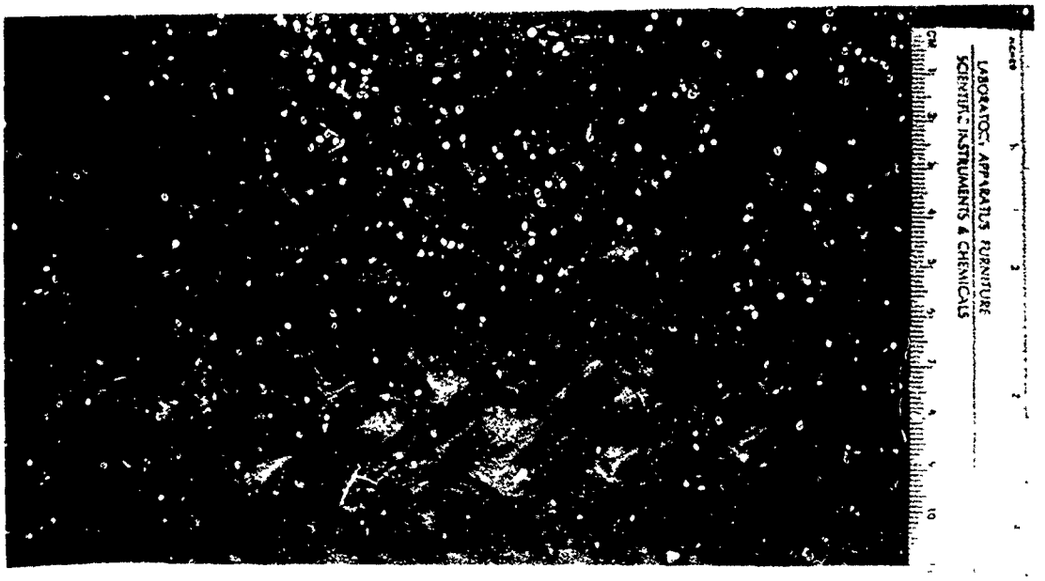


Test #38



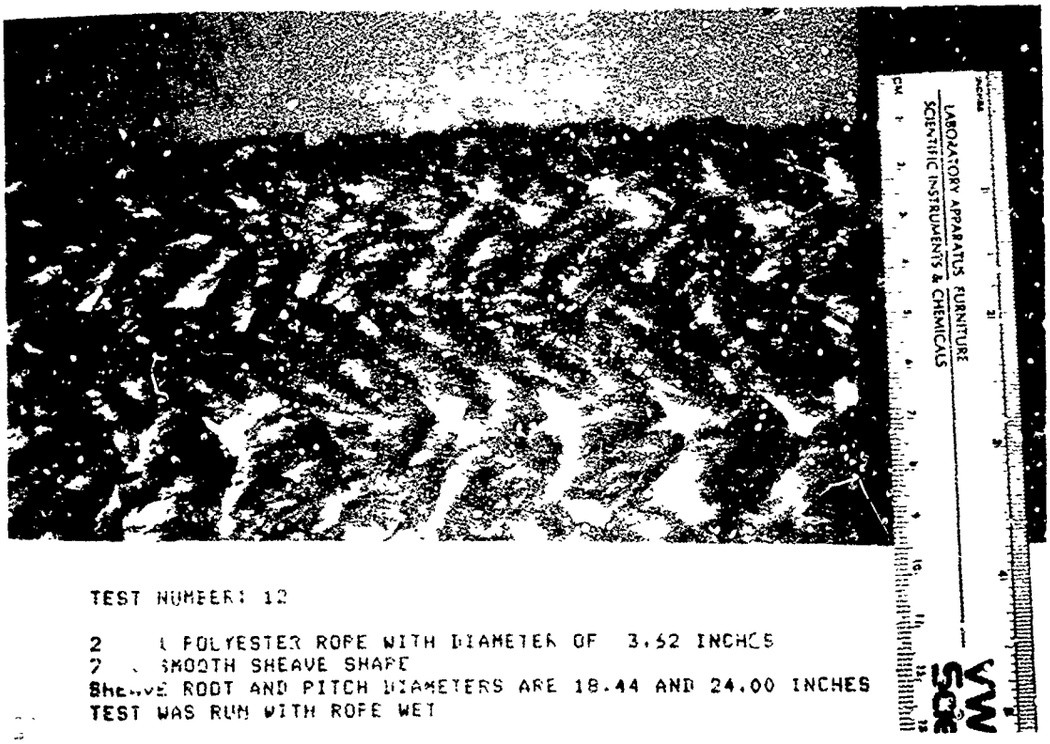
APPENDIX B

PHOTOGRAPHS OF TEST RUNS



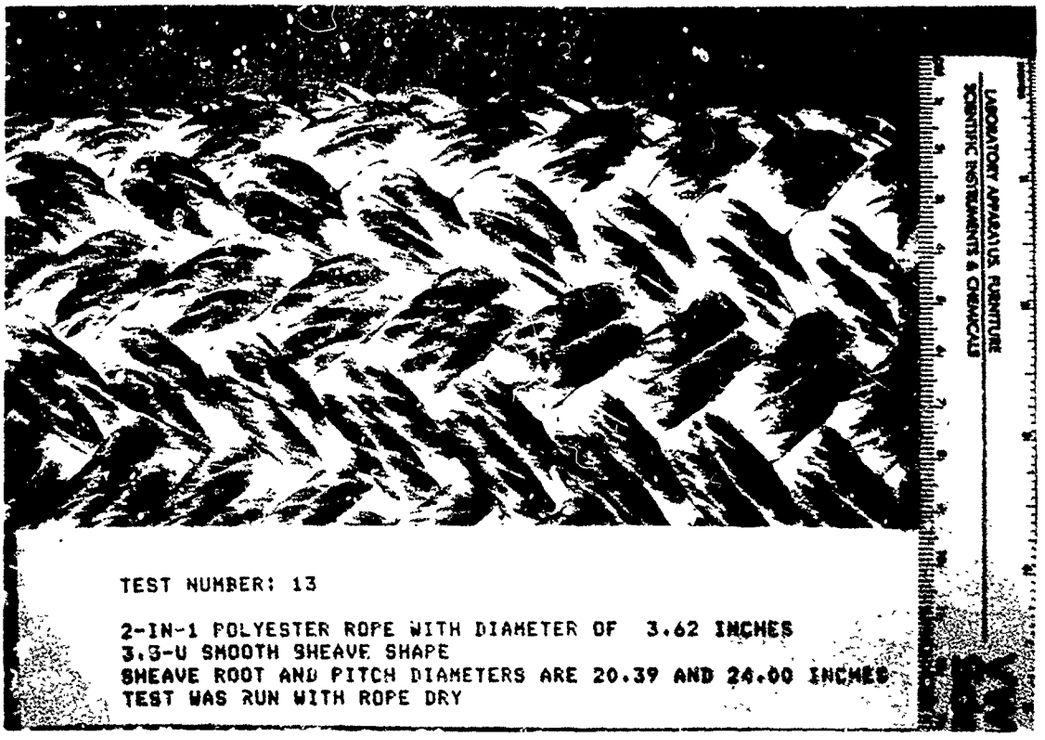
TEST NUMBER: 11

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY



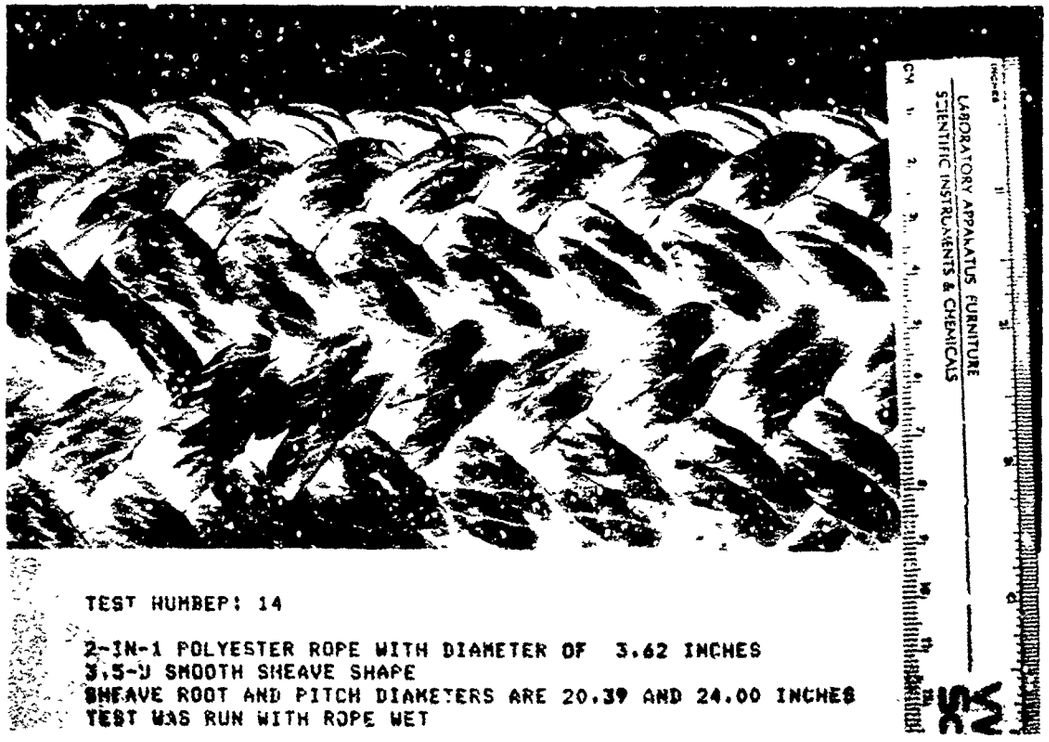
TEST NUMBER: 12

2 [illegible] POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
7[illegible] SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET



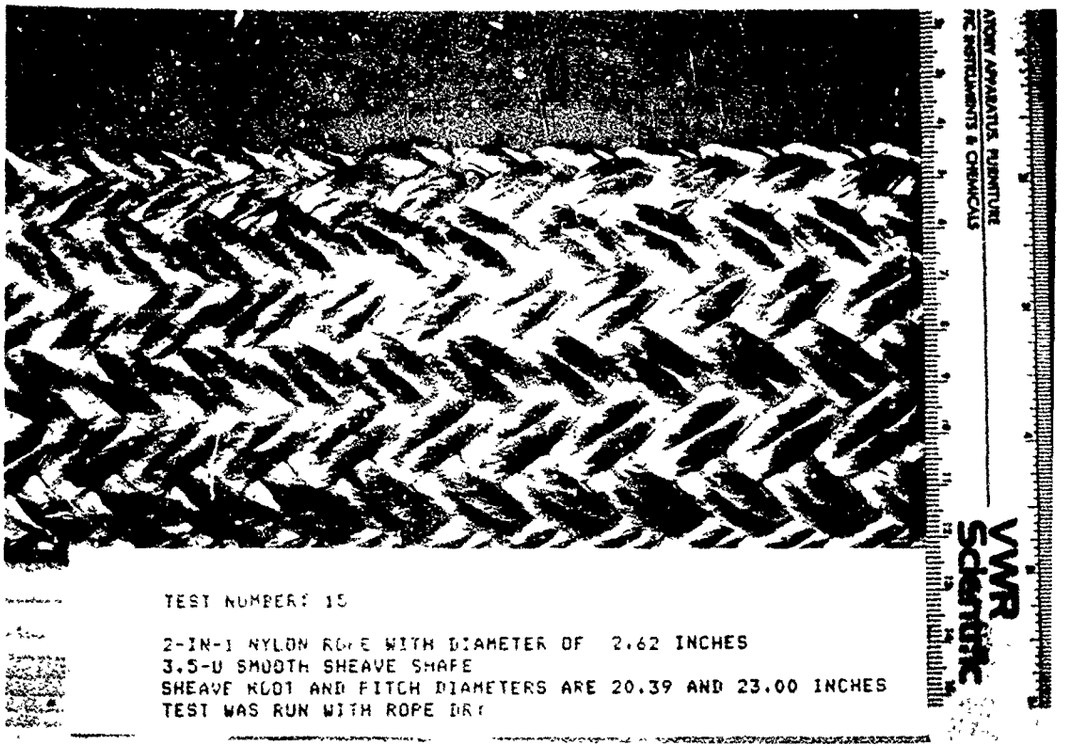
TEST NUMBER: 13

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.3-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY



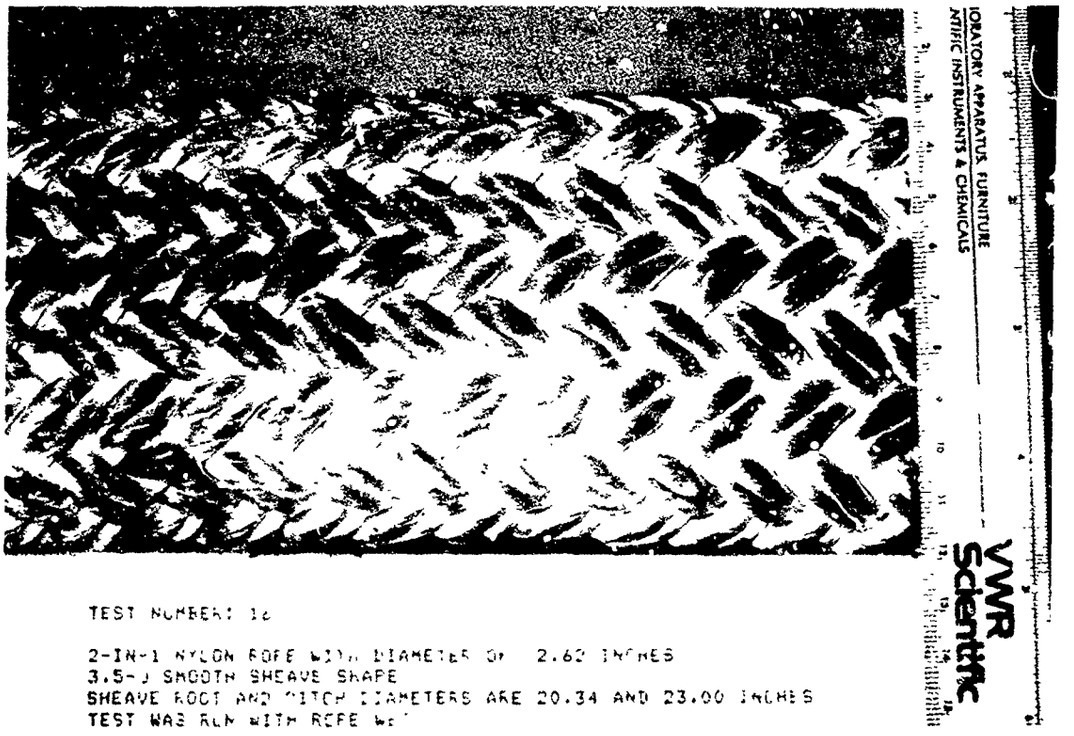
TEST NUMBER: 14

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET



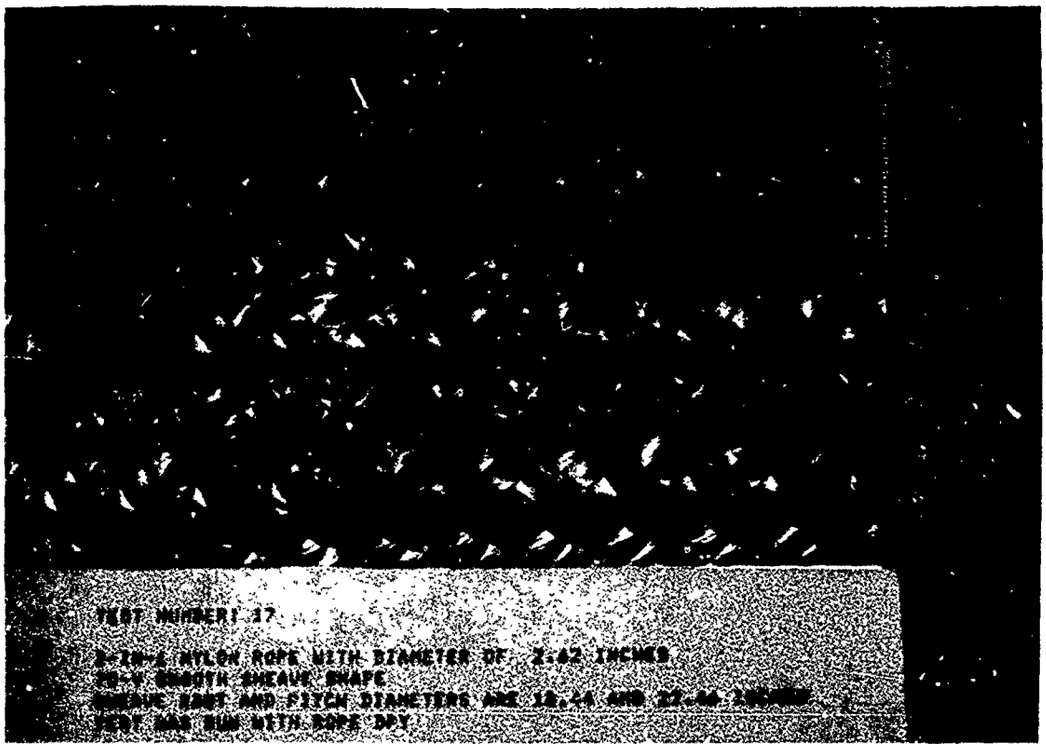
TEST NUMBER: 15

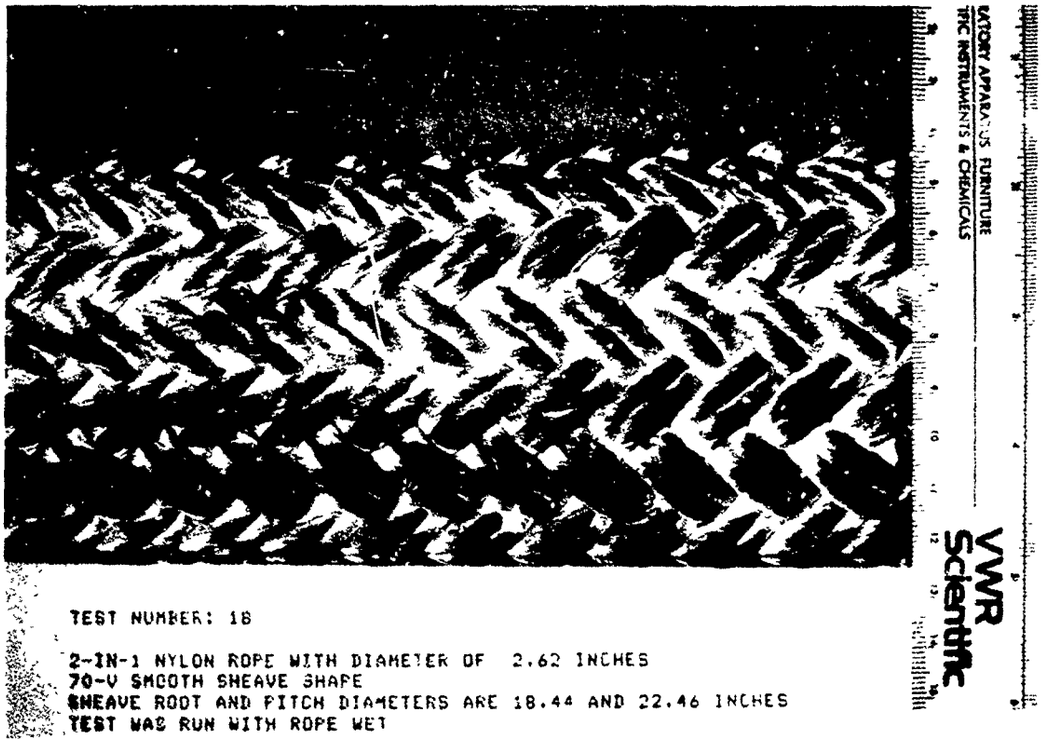
2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 23.00 INCHES
TEST WAS RUN WITH ROPE DRY

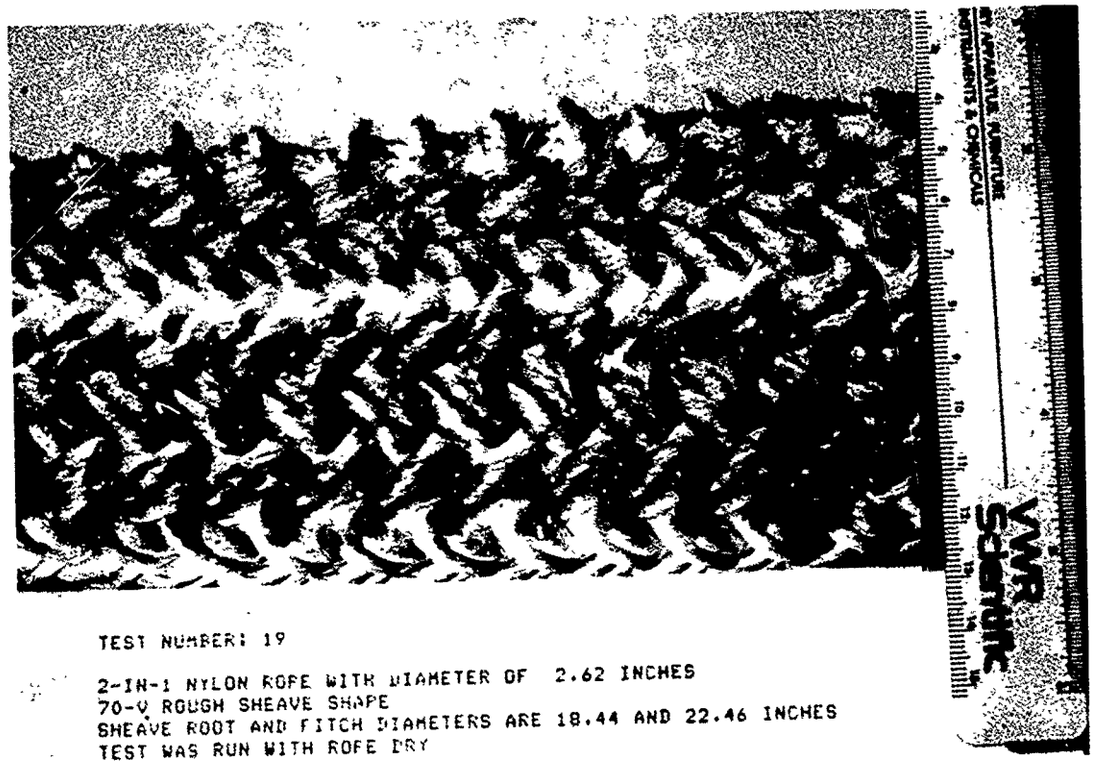


TEST NUMBER: 16

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.34 AND 23.00 INCHES
TEST WAS RUN WITH ROPE WET

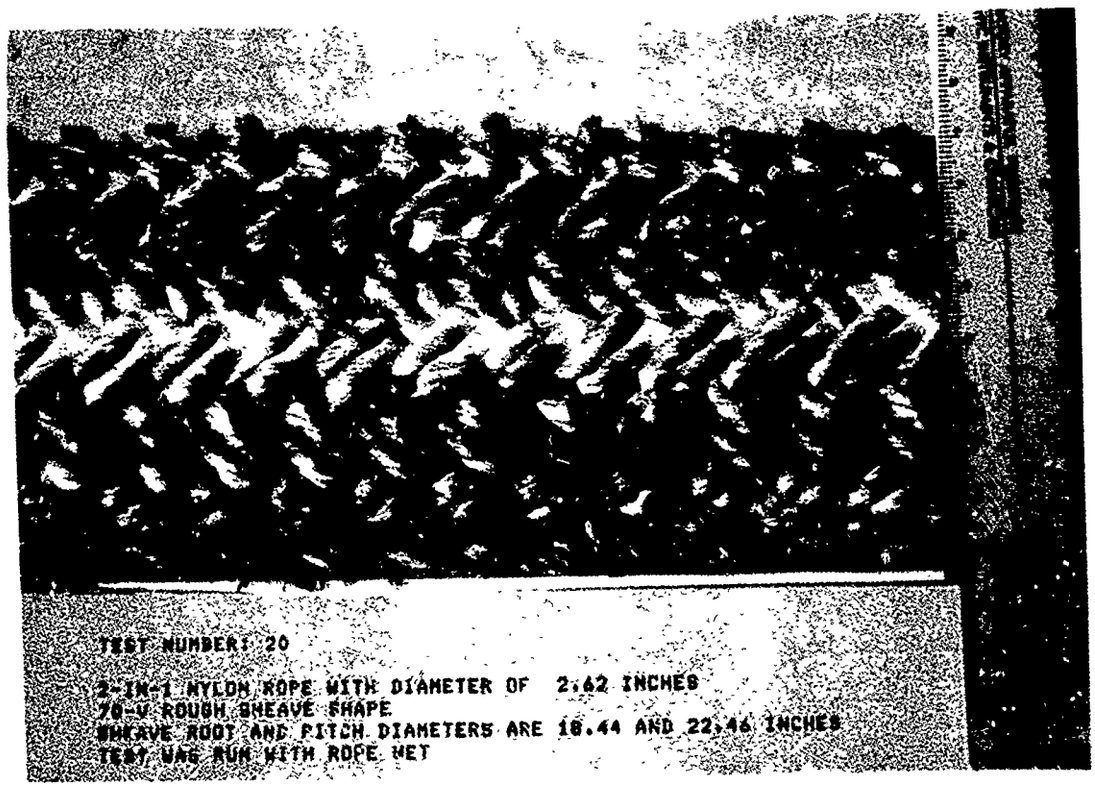

TEST NUMBER: 17
2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY


TEST NUMBER: 18
2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET
VWR Scientific



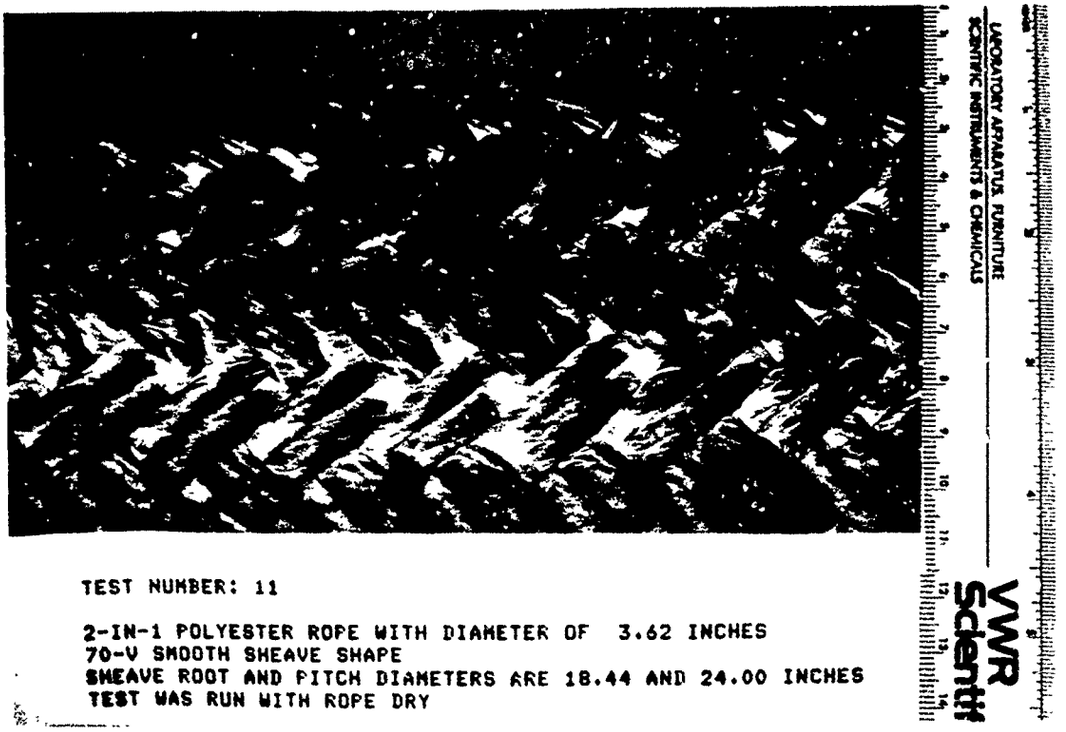
TEST NUMBER: 19

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY



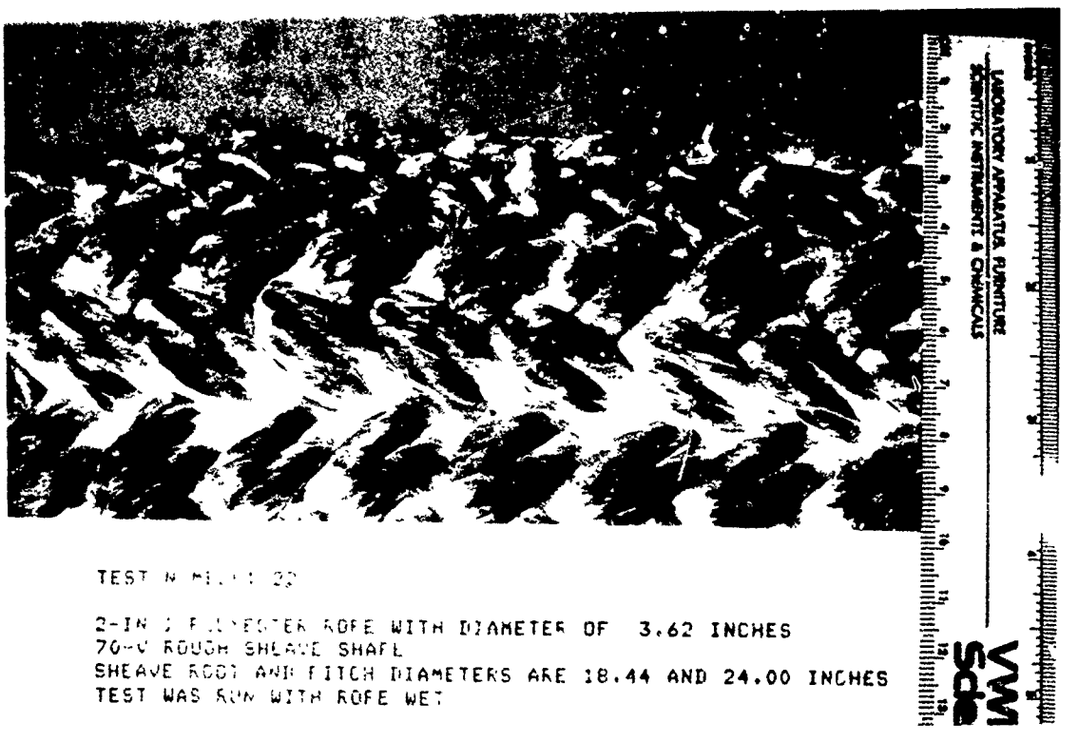
TEST NUMBER: 20

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET



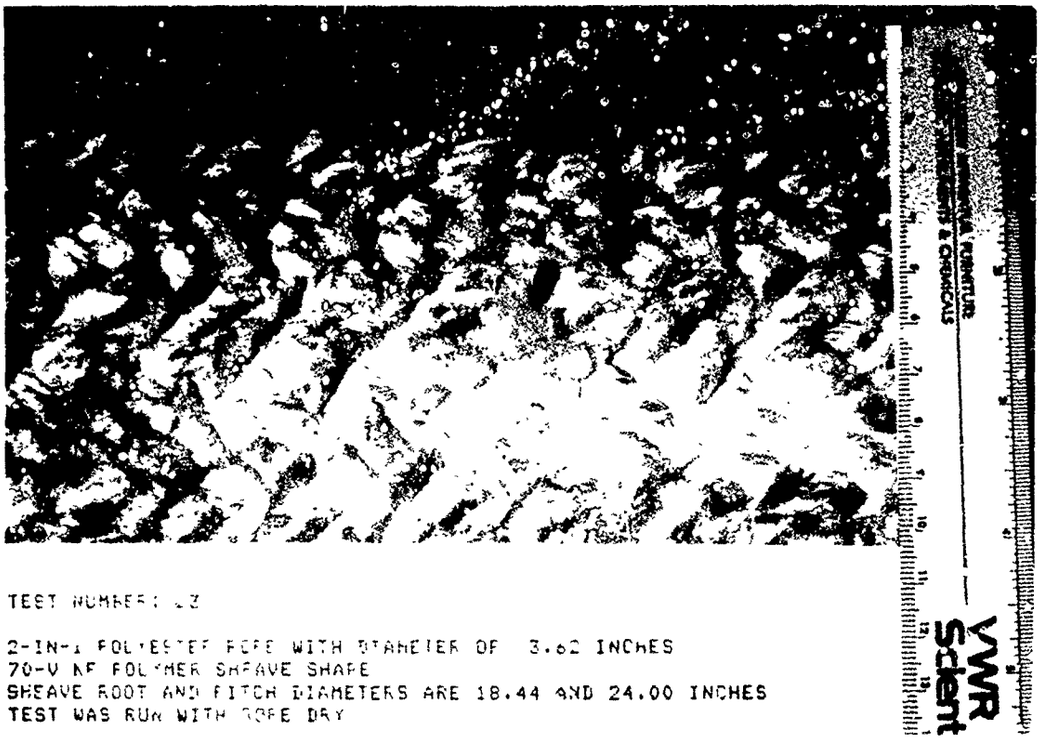
TEST NUMBER: 11

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY



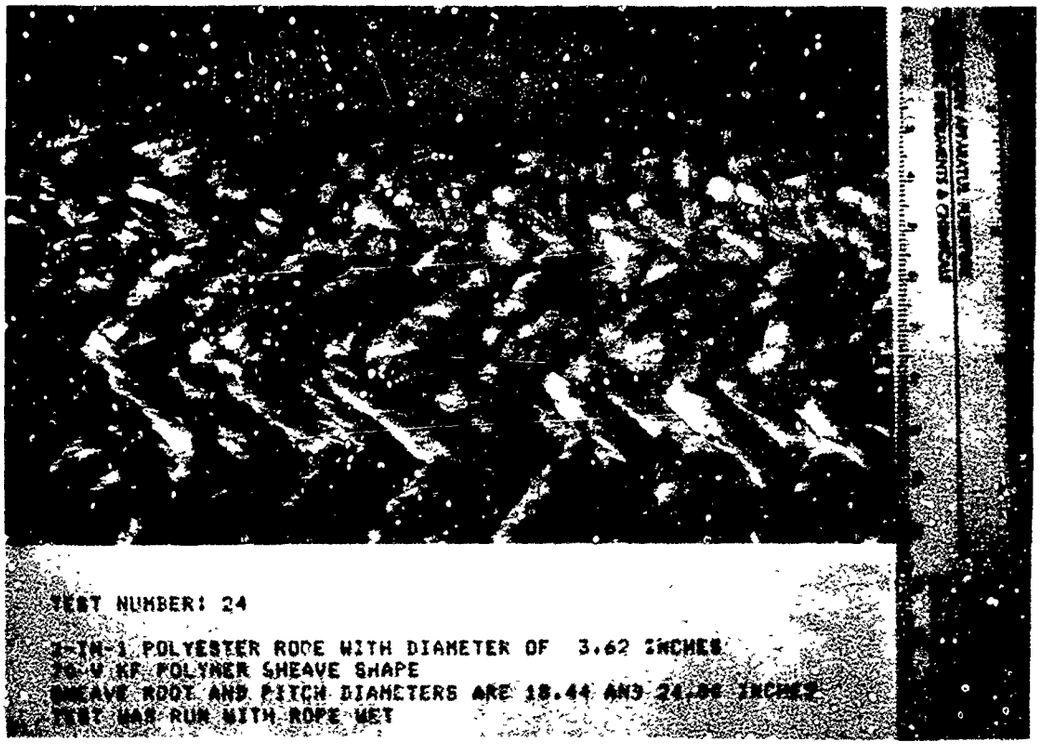
TEST NUMBER: 22

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET



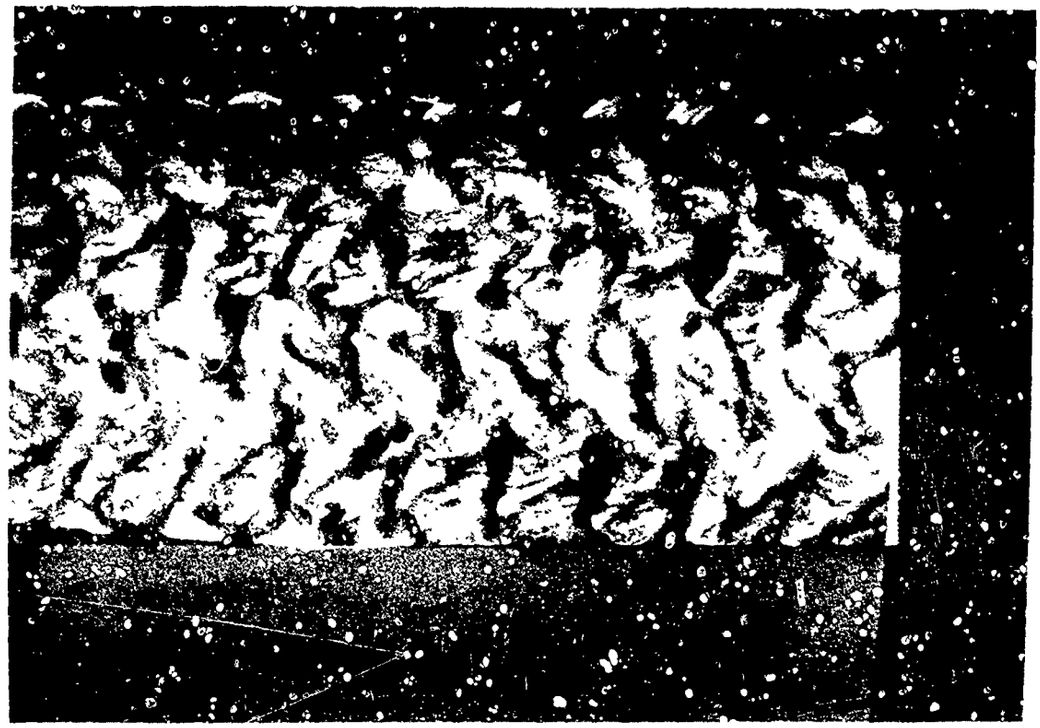
TEST NUMBER: 23

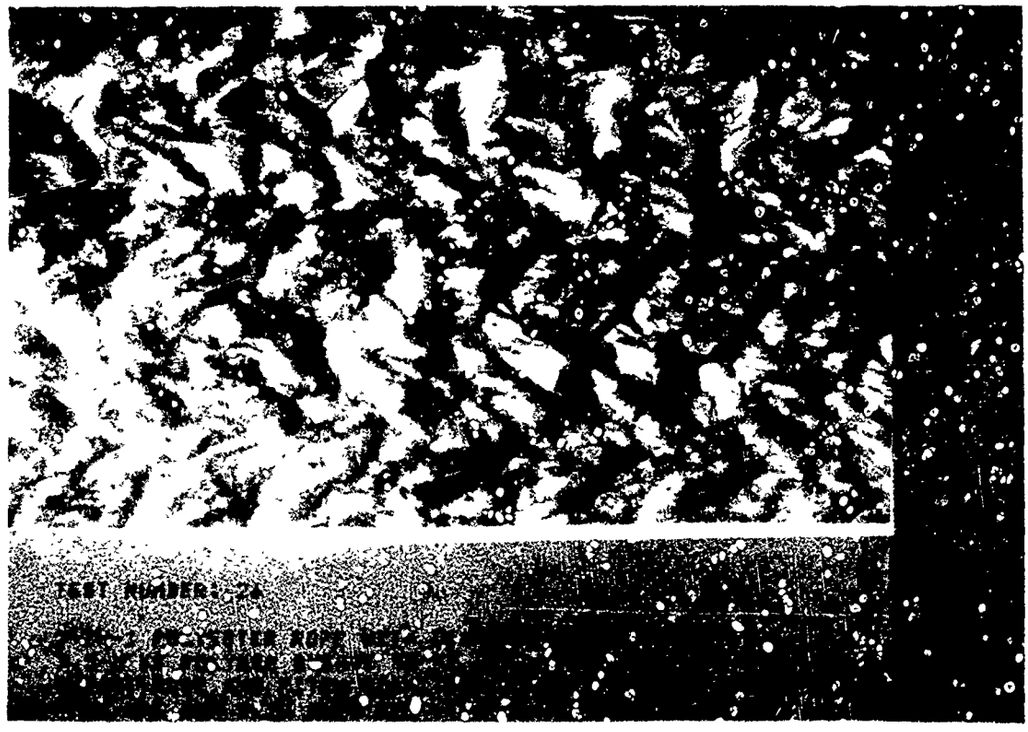
2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

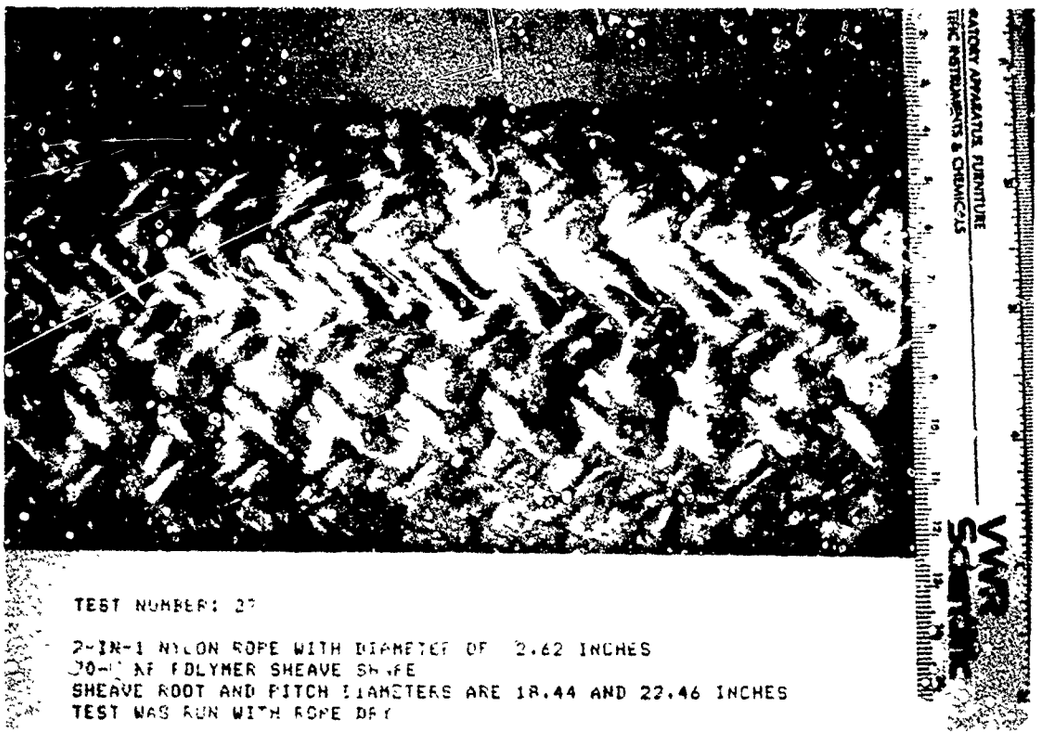


TEST NUMBER: 24

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

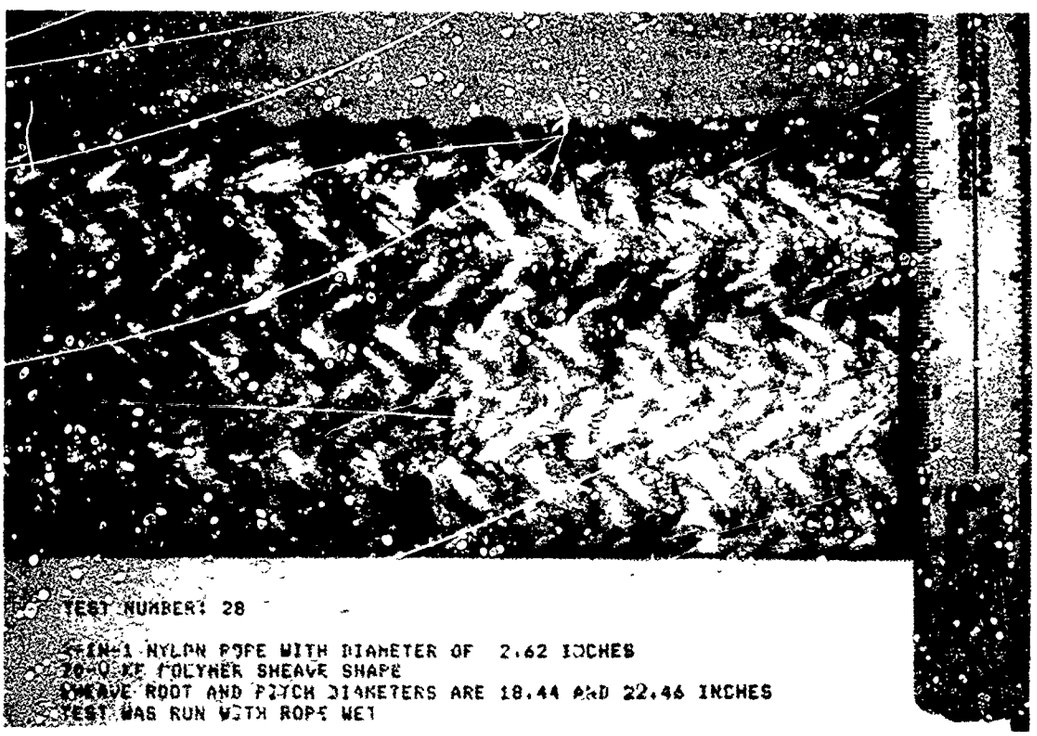



TEST NUMBER: 24



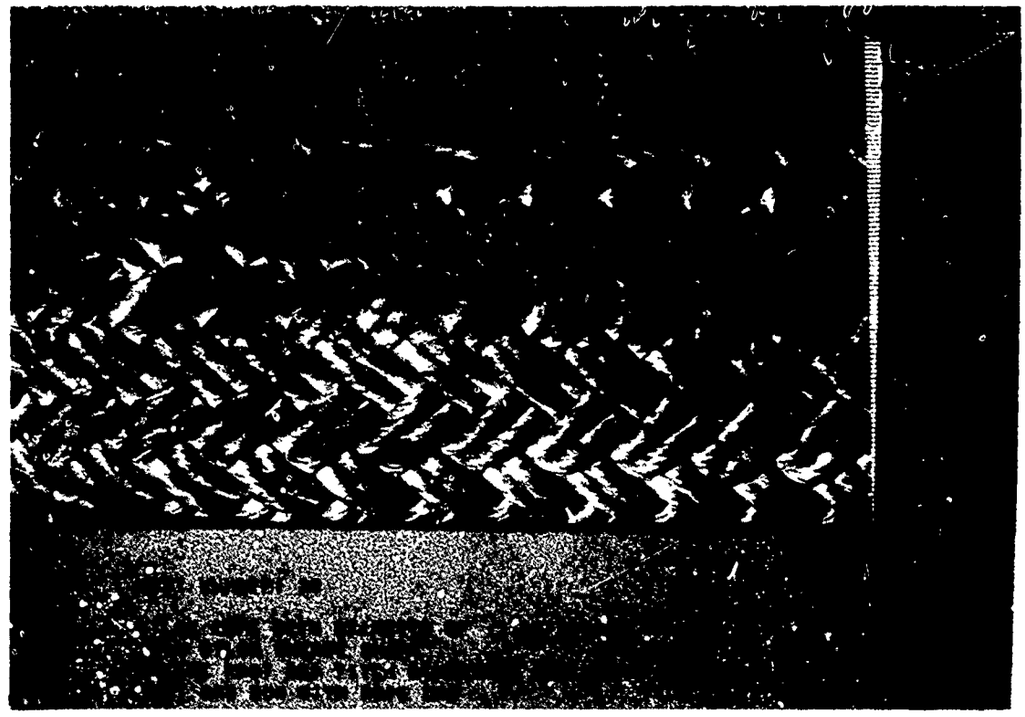
TEST NUMBER: 27

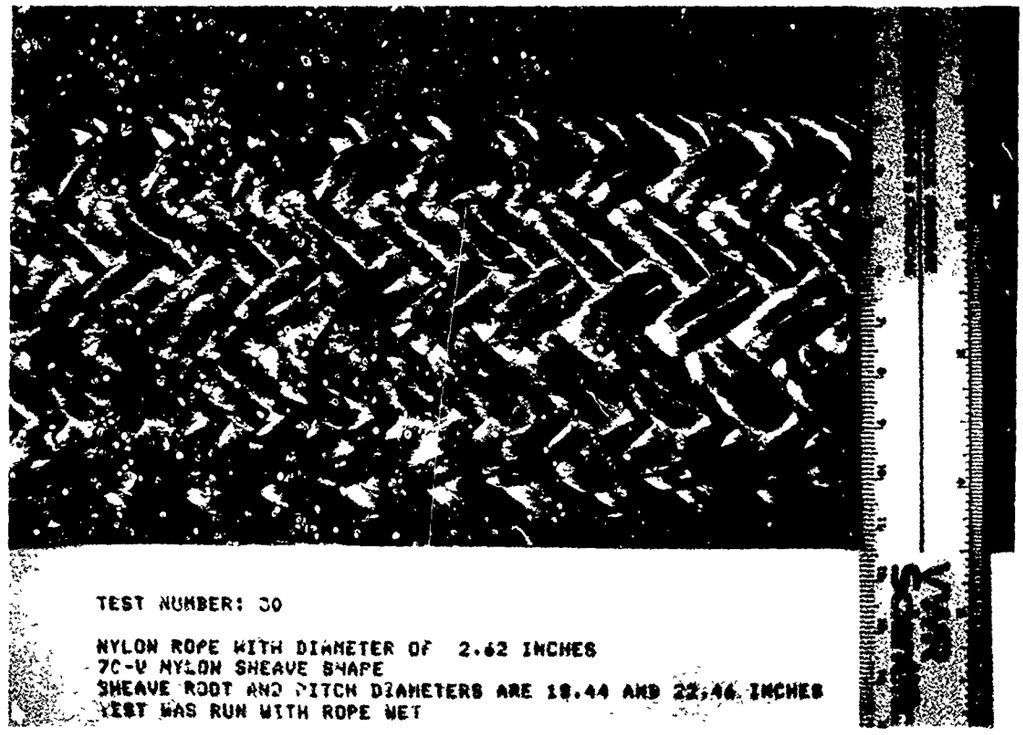
2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
30-[illegible] AF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY



TEST NUMBER: 28

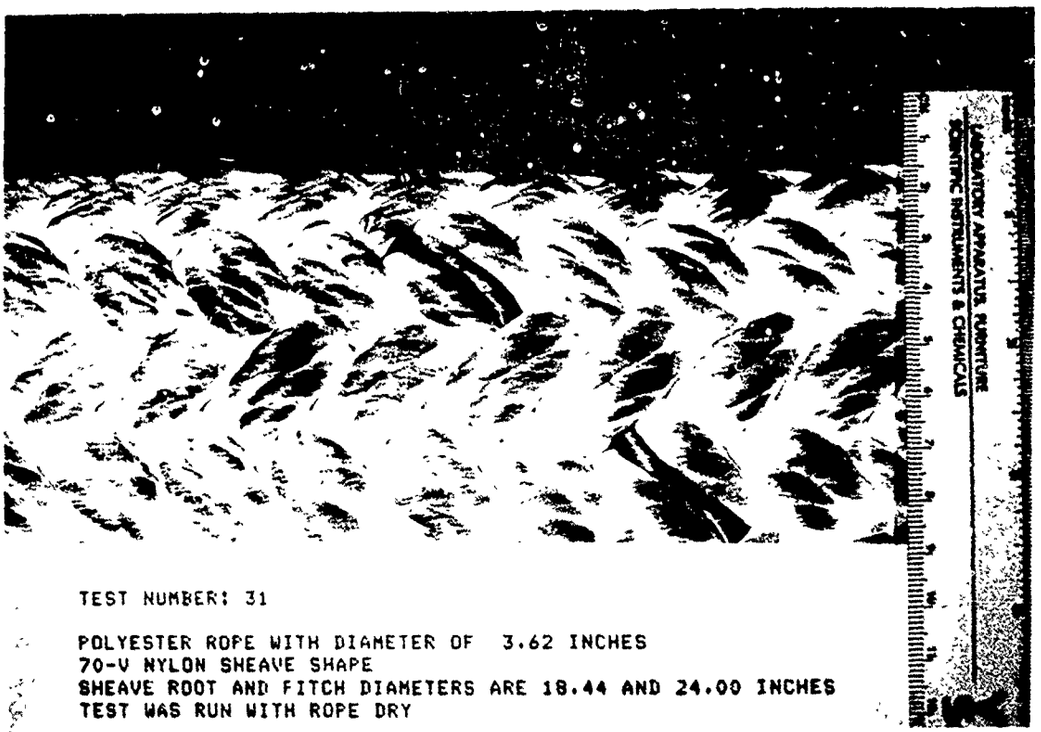
2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
30-[illegible] AF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET





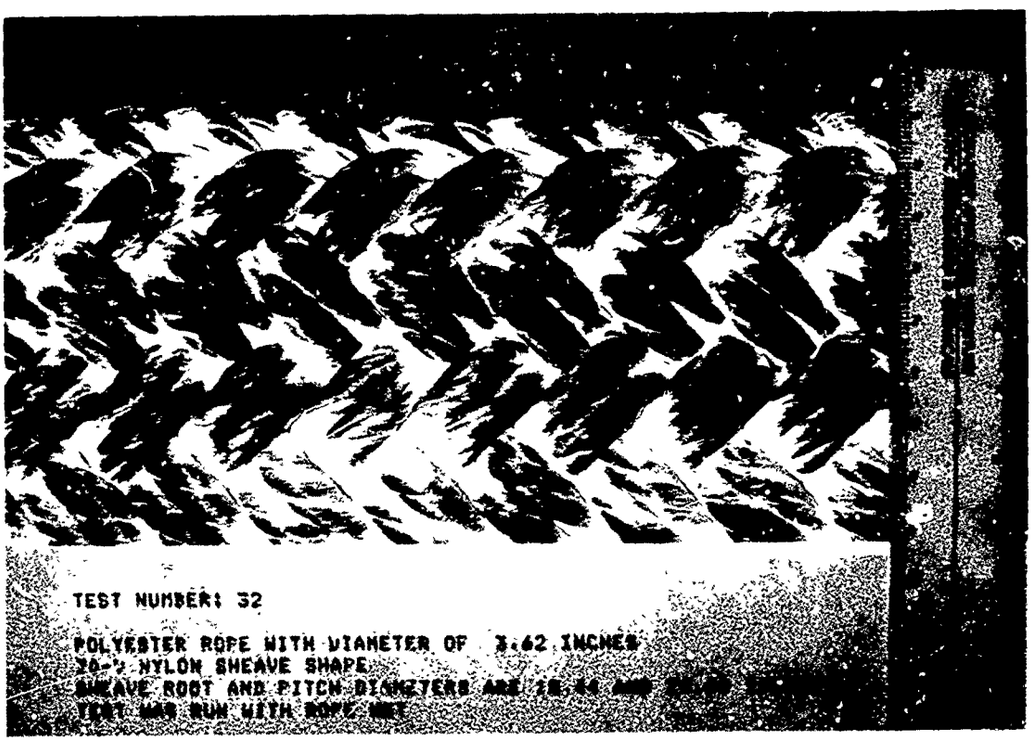
TEST NUMBER: 30

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
7C-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET



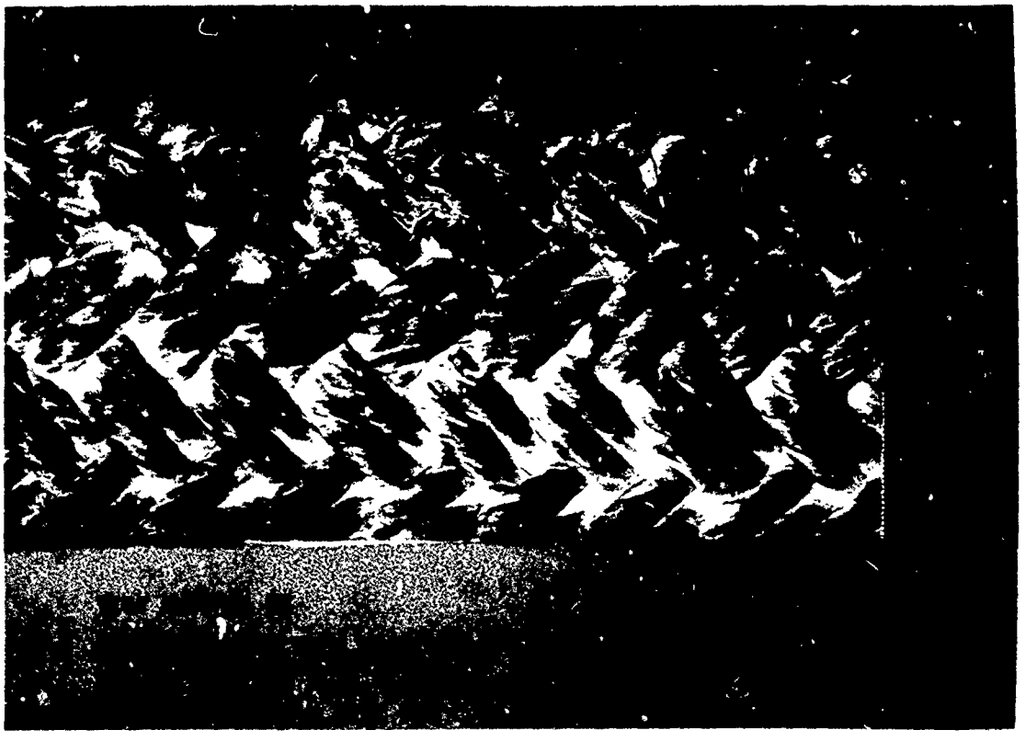
TEST NUMBER: 31

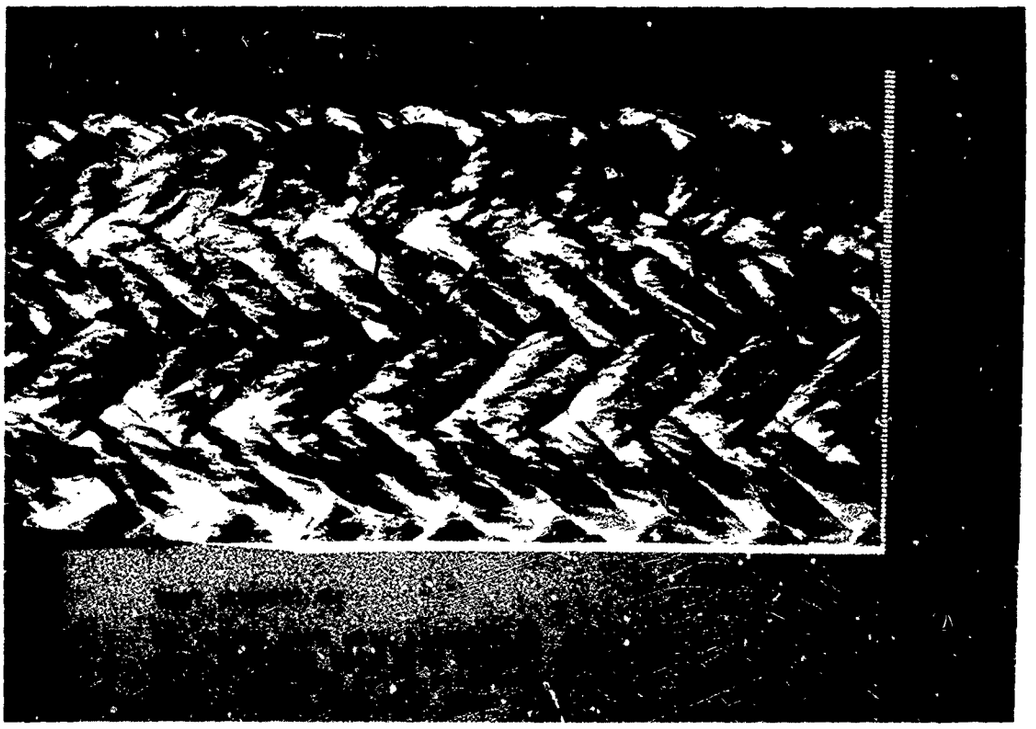
POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

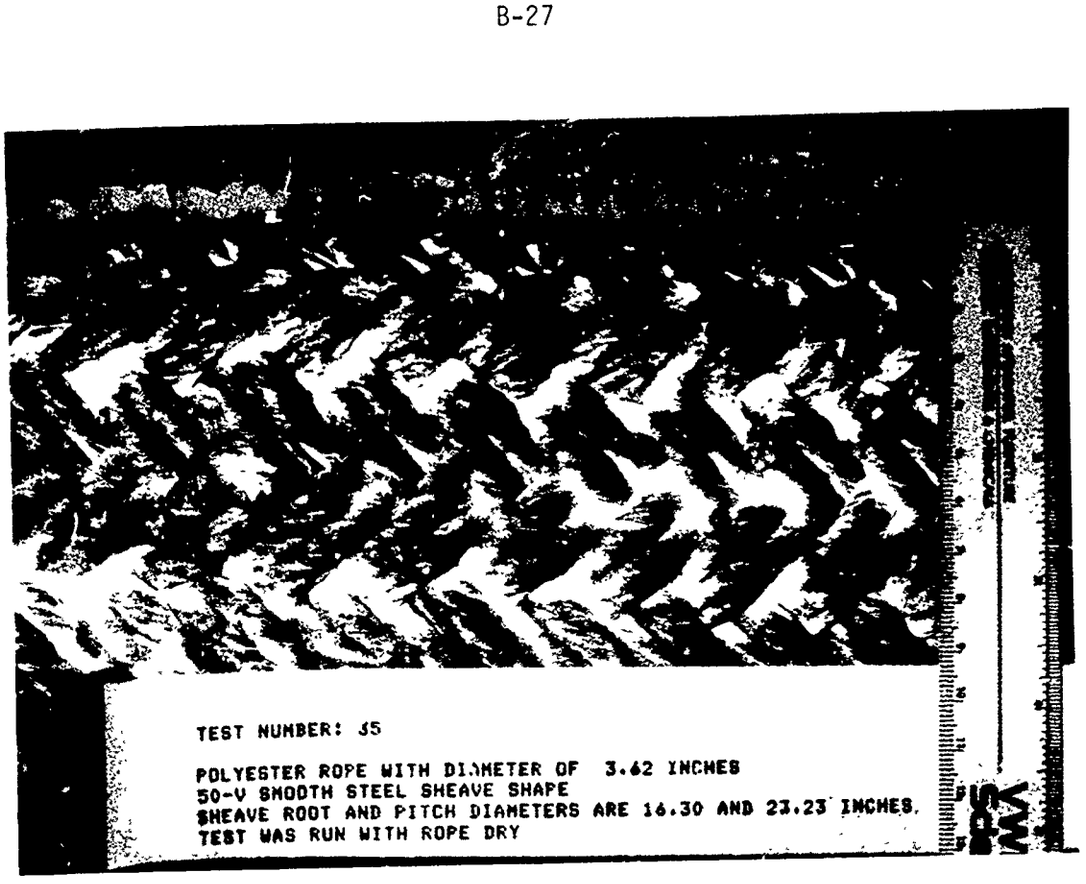


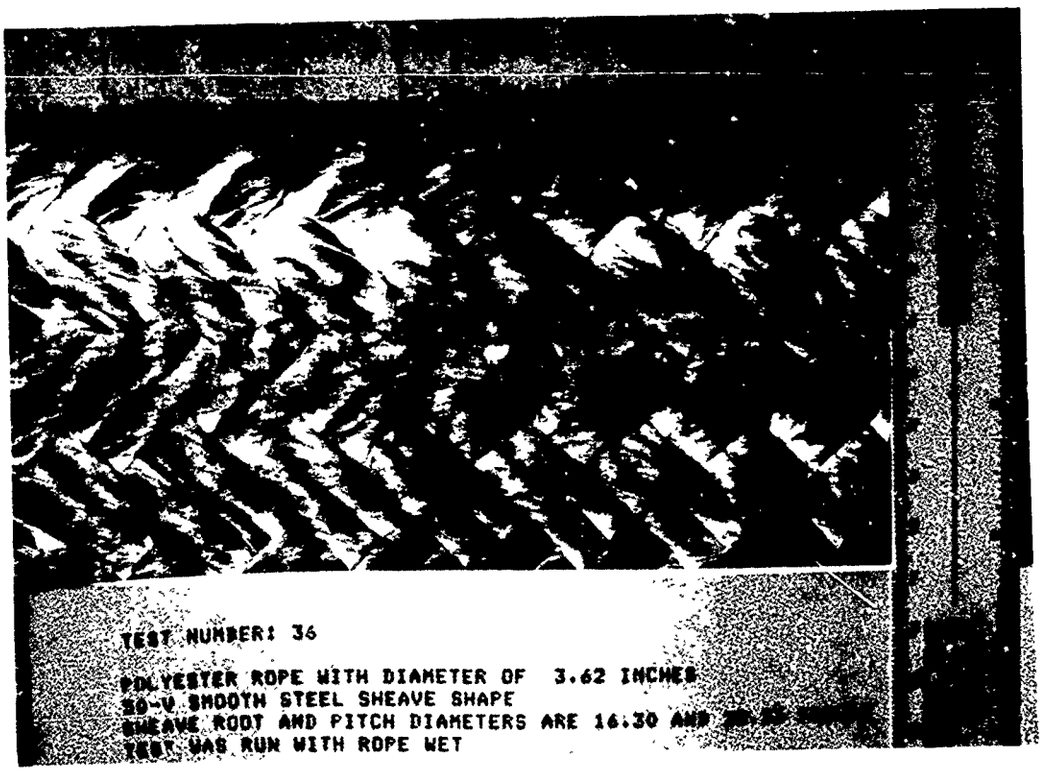
TEST NUMBER: 32

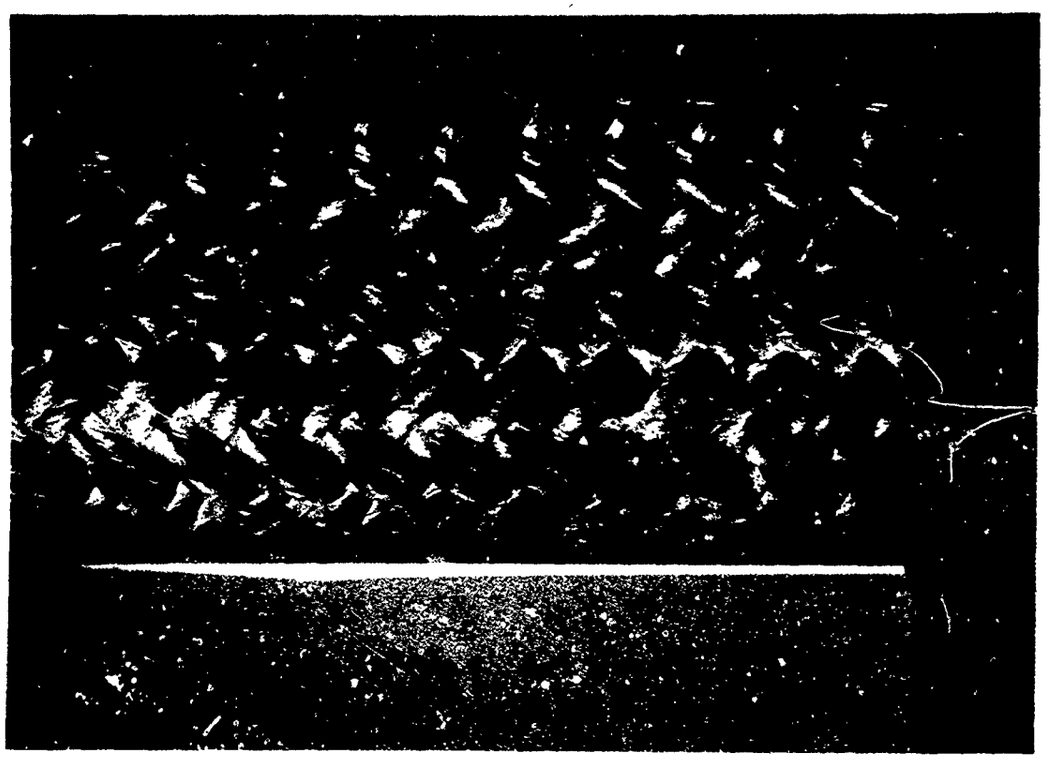
POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

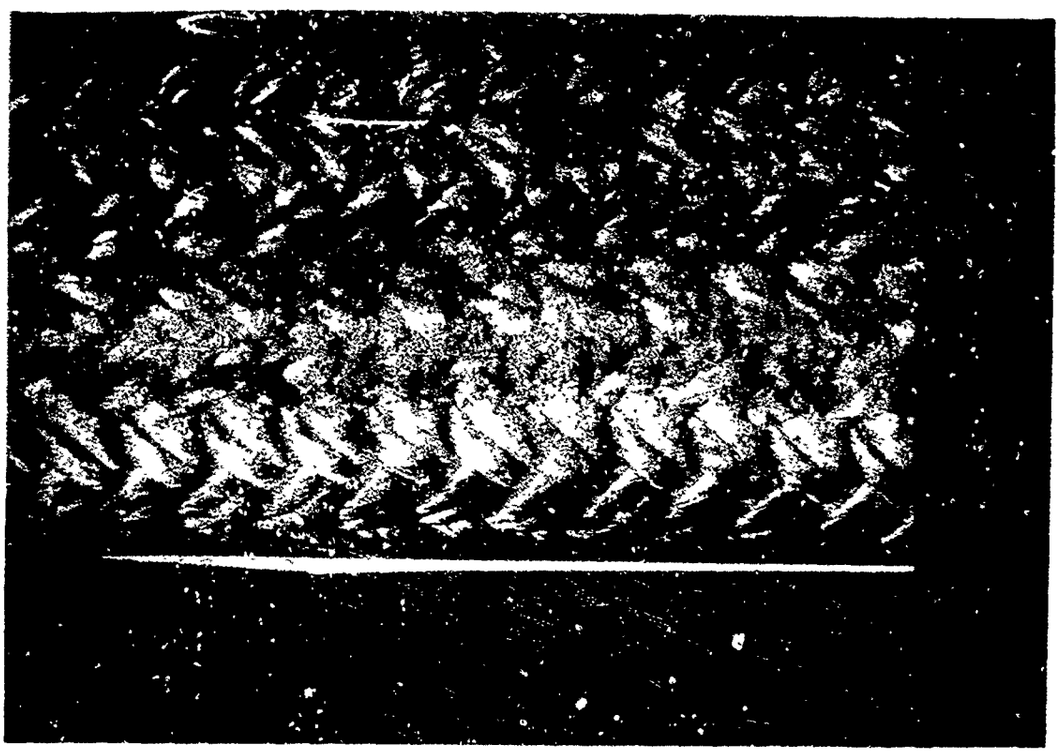





TEST NUMBER: 35
POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 16.30 AND 23.23 INCHES.
TEST WAS RUN WITH ROPE DRY


TEST NUMBER: 36
POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
TEST WAS RUN WITH ROPE WET





APPENDIX C

TABULATION OF TEST RESULTS

TEST NUMBER: 1

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
6.6	2.6	4.60	106	2.538	.297
27.0	14.6	20.80	479	1.849	.196
22.2	14.5	18.35	422	1.531	.136
42.9	27.9	35.40	815	1.538	.137
40.6	28.0	34.30	790	1.450	.118
47.7	35.0	41.35	952	1.363	.099
41.0	28.3	34.65	798	1.449	.118
39.6	28.2	33.90	780	1.404	.108
45.0	32.5	38.75	892	1.385	.104
50.0	37.0	43.50	1,001	1.351	.096
46.5	33.8	40.15	924	1.376	.102
43.5	31.1	37.30	859	1.399	.107
41.5	29.3	35.40	815	1.416	.111
37.5	26.5	32.00	737	1.415	.111
35.0	24.5	29.75	685	1.429	.114
32.5	22.3	27.40	631	1.457	.120
30.0	20.3	25.15	579	1.478	.124
27.5	18.3	22.90	527	1.503	.130
25.0	16.5	20.75	478	1.515	.132
22.5	14.6	18.55	427	1.541	.138
20.0	12.8	16.40	378	1.563	.142
17.5	11.1	14.30	329	1.577	.145
15.0	9.5	12.25	282	1.579	.145
12.5	7.7	10.10	233	1.623	.154
10.0	6.0	8.00	184	1.667	.163
8.5	5.0	6.75	155	1.700	.169

TEST NUMBER: 2

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
10.0	6.2	8.10	186	1.613	.152
15.0	10.0	12.50	288	1.500	.129
20.0	14.0	17.00	391	1.429	.114
25.2	18.5	21.85	503	1.362	.098
7.0	3.5	5.25	121	2.000	.221
15.0	10.0	12.50	288	1.500	.129
20.3	14.0	17.15	395	1.450	.118
25.0	17.5	21.25	489	1.429	.114
30.0	21.5	25.75	593	1.395	.106
35.0	25.5	30.25	696	1.373	.101
40.3	29.6	34.95	805	1.361	.098
45.3	33.8	39.55	910	1.340	.093
50.2	38.4	44.30	1,020	1.307	.085
55.3	43.0	49.15	1,131	1.286	.080

TEST NUMBER: 3

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
11.3	6.5	8.90	205	1.738	.176
12.5	7.6	10.05	231	1.645	.158
15.0	9.7	12.35	284	1.546	.139
17.5	11.2	14.35	330	1.563	.142
20.0	13.2	16.60	382	1.515	.132
22.5	15.3	18.90	435	1.471	.123
25.0	17.4	21.20	488	1.437	.115
27.5	19.3	23.40	539	1.425	.113
30.0	21.3	25.65	590	1.408	.109
32.5	23.3	27.90	642	1.395	.106
35.0	25.4	30.20	695	1.378	.102
37.5	27.5	32.50	748	1.364	.099
40.0	29.6	34.80	801	1.351	.096
42.5	31.7	37.10	854	1.341	.093
45.0	34.0	39.50	909	1.324	.089
47.5	36.0	41.75	961	1.319	.088
50.2	38.3	44.25	1,019	1.311	.086
47.5	36.0	41.75	961	1.319	.088
45.0	34.0	39.50	909	1.324	.089
42.5	31.9	37.20	856	1.332	.091
40.0	29.7	34.85	802	1.347	.095
37.5	27.7	32.60	750	1.354	.096
35.0	25.5	30.25	696	1.373	.101
32.5	23.5	28.00	645	1.383	.103
30.0	21.4	25.70	592	1.402	.108
27.5	19.4	23.45	540	1.418	.111
25.0	17.4	21.20	488	1.437	.115
22.5	15.5	19.00	437	1.452	.119
20.0	13.5	16.75	386	1.481	.125
17.5	11.5	14.50	334	1.522	.134
15.0	9.8	12.40	285	1.531	.135
12.5	8.0	10.25	236	1.563	.142
10.0	6.2	8.10	186	1.613	.152
7.5	4.5	6.00	138	1.667	.163

TEST NUMBER: 4

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 9.30 AND 14.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
42.5	26.0	34.25	1,352	1.635	.156
39.0	26.2	32.60	1,287	1.489	.127
2.5	1.5	2.00	79	1.667	.163
5.0	3.0	4.00	158	1.667	.163
7.5	4.5	6.00	237	1.667	.163
10.0	6.5	8.25	326	1.538	.137
12.5	8.5	10.50	414	1.471	.123
15.0	10.2	12.60	497	1.471	.123
17.5	12.1	14.80	584	1.446	.117
20.0	14.0	17.00	671	1.429	.114
22.5	15.6	19.05	752	1.442	.117
25.0	17.7	21.35	843	1.412	.110
27.5	20.0	23.75	937	1.375	.101
30.0	22.0	26.00	1,026	1.364	.099
32.5	24.2	28.35	1,119	1.343	.094
35.0	26.0	30.50	1,204	1.346	.095
37.5	28.1	32.80	1,294	1.335	.092
40.0	30.2	35.10	1,385	1.325	.089
42.5	32.4	37.45	1,478	1.312	.086
45.0	34.5	39.75	1,569	1.304	.085
47.5	36.5	42.00	1,657	1.301	.084
50.0	38.9	44.45	1,754	1.285	.080
47.5	36.8	42.15	1,663	1.291	.081
45.0	34.2	39.60	1,563	1.316	.087
42.5	32.0	37.25	1,470	1.328	.090
40.0	29.8	34.90	1,377	1.342	.094
37.5	28.1	32.80	1,294	1.335	.092
35.0	25.2	30.10	1,188	1.389	.105
32.5	23.0	27.75	1,095	1.413	.110
30.0	20.8	25.40	1,002	1.442	.117
27.5	18.8	23.15	914	1.463	.121
25.0	16.8	20.90	825	1.488	.127
22.5	15.0	18.75	740	1.500	.129
20.0	13.0	16.50	651	1.538	.137
17.5	11.1	14.30	564	1.577	.145
15.0	9.3	12.15	479	1.613	.152
12.5	7.7	10.10	399	1.623	.154
10.0	6.0	8.00	316	1.667	.163
7.5	4.5	6.00	237	1.667	.163
6.3	3.7	5.00	197	1.703	.169

TEST NUMBER: 5

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 9.30 AND 14.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
37.5	24.5	31.00	1,223	1.531	.135
35.0	25.0	30.00	1,184	1.400	.107
7.1	3.6	5.35	211	1.972	.216
10.0	5.7	7.85	310	1.754	.179
15.0	9.0	12.00	474	1.667	.163
20 0	12.9	16.45	649	1.550	.140
25.0	17.1	21.05	831	1.462	.121
30.0	21.6	25.80	1,018	1.389	.105
35.0	26.2	30.60	1,208	1.336	.092
40.0	30.7	35.35	1,395	1.303	.084
45.0	35.2	40.10	1,582	1.278	.078
49.0	39.0	44.00	1,736	1.256	.073
33.8	23.1	28.45	1,123	1.463	.121
33.5	23.2	28.35	1,119	1.444	.117
7.0	3.5	5.25	207	2.000	.221
10.0	5.5	7.75	306	1.818	.190
15.0	9.2	12.10	478	1.630	.156
20.0	13.5	16.75	661	1.481	.125
25.0	17.7	21.35	843	1.412	.110
30.0	22.2	26.10	1,030	1.351	.096
35.0	26.4	30.70	1,212	1.326	.090
40.0	30.5	35.25	1,391	1.311	.086
45.0	35.0	40.00	1,579	1.286	.080
50.0	39.7	44.85	1,770	1.259	.073
45.0	34.5	39.75	1,569	1.304	.085
40.0	29.5	34.75	1,371	1.356	.097
35.0	24.9	29.95	1,182	1.406	.108
30.0	20.5	25.25	996	1.463	.121
25.0	16.6	20.80	821	1.506	.130
20.0	12.8	16.40	647	1.563	.142
15.0	9.1	12.05	476	1.648	.159
10.0	5.7	7.85	310	1.754	.179
10.0	6.1	8.05	318	1.639	.157
15.0	9.9	12.45	491	1.515	.132
20.0	13.7	16.85	665	1.460	.120
25.0	18.1	21.55	850	1.381	.103
30.0	22.6	26.30	1,038	1.327	.090
35.0	27.2	31.10	1,227	1.287	.080
40.0	31.8	35.90	1,417	1.258	.073
45.0	36.8	40.90	1,614	1.223	.064
50.0	41.7	45.85	1,809	1.199	.058
45.0	36.0	40.50	1,598	1.250	.071
40.0	30.9	35.45	1,399	1.295	.082
35.0	26.0	30.50	1,204	1.346	.095
30.0	21.4	25.70	1,014	1.402	.108
25.0	17.1	21.05	831	1.462	.121
20.0	13.2	16.60	655	1.515	.132
15.0	9.4	12.20	481	1.596	.149
10.0	6.9	8.45	333	1.449	.118

TEST NUMBER: 6

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 2.00 INCHES
70-V SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 9.30 AND 11.38 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	3.1	4.05	356	1.613	.152
10.0	6.3	8.15	716	1.587	.147
15.0	10.1	12.55	1,103	1.485	.126
20.0	13.8	16.90	1,485	1.449	.118
25.0	18.0	21.50	1,889	1.389	.105
20.0	13.5	16.75	1,472	1.481	.125
15.0	9.7	12.35	1,085	1.546	.139
10.0	6.0	8.00	703	1.667	.163
7.4	4.3	5.85	514	1.721	.173
10.0	6.4	8.20	721	1.563	.142
15.0	10.2	12.60	1,107	1.471	.123
20.0	14.2	17.10	1,503	1.408	.109
25.1	18.6	21.85	1,920	1.349	.095
20.0	13.8	16.90	1,485	1.449	.118
15.0	9.7	12.35	1,085	1.546	.139
10.0	6.0	8.00	703	1.667	.163
7.4	4.2	5.80	510	1.762	.180

TEST NUMBER: 7

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 2.00 INCHES
3.5-U SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 11.32 AND 13.32 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
4.0	3.0	3.50	263	1.333	.092
5.0	4.0	4.50	338	1.250	.071
10.0	7.6	8.80	661	1.316	.087
15.0	11.6	13.30	998	1.293	.082
20.0	15.9	17.95	1,348	1.258	.073
25.0	21.0	23.00	1,727	1.190	.055
20.0	16.5	18.25	1,370	1.212	.061
15.0	12.1	13.55	1,017	1.240	.068
10.0	8.0	9.00	676	1.250	.071
6.0	5.0	5.50	413	1.200	.058
10.0	8.7	9.35	702	1.149	.044
15.0	12.5	13.75	1,032	1.200	.058
20.0	16.9	18.45	1,385	1.183	.054
25.0	21.2	23.10	1,734	1.179	.052
20.0	16.3	18.15	1,363	1.227	.065
15.0	12.2	13.60	1,021	1.230	.066
10.0	8.0	9.00	676	1.250	.071
6.5	5.1	5.80	435	1.275	.077

TEST NUMBER: 8

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 11.32 AND 15.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
43.3	27.7	35.50	1,308	1.563	.142
38.7	28.0	33.35	1,228	1.382	.103
5.8	3.0	4.40	162	1.933	.210
10.0	6.5	8.25	304	1.538	.137
15.0	10.5	12.75	470	1.429	.114
20.0	14.7	17.35	639	1.361	.098
25.0	18.9	21.95	808	1.323	.089
30.0	23.2	26.60	980	1.293	.082
35.0	27.1	31.05	1,144	1.292	.081
40.0	31.3	35.65	1,313	1.278	.078
45.0	35.6	40.30	1,484	1.264	.075
50.0	39.5	44.75	1,648	1.266	.075
45.0	34.2	39.60	1,459	1.316	.087
40.0	29.9	34.95	1,287	1.338	.093
35.0	25.4	30.20	1,112	1.378	.102
30.0	21.3	25.65	945	1.408	.109
25.0	17.0	21.00	773	1.471	.123
20.0	13.1	16.55	610	1.527	.135
15.0	9.4	12.20	449	1.596	.149
10.0	6.7	8.35	308	1.493	.127
6.4	3.5	4.95	182	1.829	.192
10.0	6.6	8.30	306	1.515	.132
15.5	11.0	13.25	488	1.409	.109
20.0	15.2	17.60	648	1.316	.087
25.0	19.2	22.10	814	1.302	.084
30.0	23.5	26.75	985	1.277	.078
35.0	27.7	31.35	1,155	1.264	.074
40.0	31.7	35.85	1,320	1.262	.074
45.0	35.9	40.45	1,490	1.253	.072
50.0	40.1	45.05	1,659	1.247	.070
45.0	35.0	40.00	1,473	1.286	.080
40.0	30.3	35.15	1,295	1.320	.088
35.0	25.7	30.35	1,118	1.362	.098
30.0	21.3	25.65	945	1.408	.109
25.0	17.5	21.25	783	1.429	.114
20.0	13.5	16.75	617	1.481	.125
15.0	9.7	12.35	455	1.546	.139
10.0	6.0	8.00	295	1.667	.163
6.5	3.6	5.05	186	1.806	.188

TEST NUMBER: 9

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 11.32 AND 15.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
34.5	24.5	29.50	1,087	1.408	.109
32.3	24.5	28.40	1,046	1.318	.088
7.1	4.0	5.55	204	1.775	.183
10.0	6.8	8.40	309	1.471	.123
15.0	11.2	13.10	483	1.339	.093
20.0	15.6	17.80	656	1.282	.079
25.0	19.8	22.40	825	1.263	.074
30.5	24.0	27.25	1,004	1.271	.076
35.0	28.7	31.85	1,173	1.220	.063
40.0	32.7	36.35	1,339	1.223	.064
45.0	35.1	40.05	1,475	1.282	.079
50.0	38.6	44.30	1,632	1.295	.082
45.0	33.4	39.20	1,444	1.347	.095
40.0	29.0	34.50	1,271	1.379	.102
35.0	25.2	30.10	1,109	1.389	.105
30.0	20.7	25.35	934	1.449	.118
25.0	17.1	21.05	775	1.462	.121
20.0	13.2	16.60	611	1.515	.132
15.0	9.5	12.25	451	1.579	.145
10.0	6.0	8.00	295	1.667	.163
6.8	3.8	5.30	195	1.789	.185
10.0	7.7	8.85	326	1.299	.083
14.8	10.7	12.75	470	1.383	.103
19.6	15.0	17.30	637	1.307	.085
25.0	20.3	22.65	834	1.232	.066
30.0	24.5	27.25	1,004	1.224	.064
35.0	27.7	31.35	1,155	1.264	.074
40.6	31.3	35.95	1,324	1.297	.083
45.1	35.0	40.05	1,475	1.289	.081
40.0	29.6	34.80	1,282	1.351	.096
35.0	25.4	30.20	1,112	1.378	.102
30.0	21.3	25.65	945	1.408	.109
25.0	17.1	21.05	775	1.462	.121
20.0	13.3	16.65	613	1.504	.130
15.0	9.7	12.35	455	1.546	.139
10.0	6.2	8.10	298	1.613	.152
5.5	3.2	4.35	160	1.719	.172

TEST NUMBER: 10

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
45-V SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 8.99 AND 14.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
35.2	18.2	26.70	1,054	1.934	.210
29.8	19.5	24.65	973	1.528	.135
7.0	4.0	5.50	217	1.750	.178
10.0	6.4	8.20	324	1.563	.142
15.0	10.1	12.55	495	1.485	.126
20.0	14.0	17.00	671	1.429	.114
25.0	17.7	21.35	843	1.412	.110
30.0	21.5	25.75	1,016	1.395	.106
35.0	25.5	30.25	1,194	1.373	.101
40.0	29.9	34.95	1,379	1.338	.093
40.0	30.1	35.05	1,383	1.329	.091
35.0	25.8	30.40	1,200	1.357	.097
30.0	21.0	25.50	1,006	1.429	.114
25.0	17.0	21.00	829	1.471	.123
20.0	13.2	16.60	655	1.515	.132
15.0	9.6	12.30	485	1.563	.142
10.0	6.3	8.15	322	1.587	.147
5.8	3.6	4.70	185	1.611	.152
10.0	7.0	8.50	335	1.429	.114
15.0	10.7	12.85	507	1.402	.108
20.0	14.5	17.25	681	1.379	.102
25.0	18.7	21.85	862	1.337	.092
30.0	22.6	26.30	1,038	1.327	.090
35.0	26.8	30.90	1,219	1.306	.085
40.0	30.5	35.25	1,391	1.311	.086
45.0	34.5	39.75	1,569	1.304	.085
50.0	38.4	44.20	1,744	1.302	.084
45.0	33.3	39.15	1,545	1.351	.096
40.0	28.7	34.35	1,356	1.394	.106
35.0	24.1	29.55	1,166	1.452	.119
30.0	20.1	25.05	989	1.493	.127
25.0	16.1	20.55	811	1.553	.140
20.0	12.5	16.25	641	1.600	.150
15.0	9.2	12.10	478	1.630	.156
10.0	6.0	8.00	316	1.667	.163
6.2	3.7	4.95	195	1.676	.164

TEST NUMBER: 11

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
20.2	10.7	15.45	356	1.888	.202
20.5	10.9	15.70	361	1.881	.201
25.0	13.6	19.30	444	1.838	.194
28.0	15.5	21.75	501	1.806	.188
32.0	17.6	24.80	571	1.818	.190
35.5	20.0	27.75	639	1.775	.183
40.0	22.9	31.45	724	1.747	.178
44.0	25.5	34.75	800	1.725	.174
47.5	27.9	37.70	868	1.703	.169
50.0	29.7	39.85	917	1.684	.166
45.0	25.0	35.00	806	1.800	.187
40.0	22.4	31.20	718	1.786	.185
35.0	19.4	27.20	626	1.804	.188
30.0	16.3	23.15	533	1.840	.194
25.0	13.1	19.05	439	1.908	.206
20.0	10.1	15.05	346	1.980	.217
15.0	7.3	11.15	257	2.055	.229
10.0	4.6	7.30	168	2.174	.247
7.4	3.3	5.35	123	2.242	.257
12.0	5.8	8.90	205	2.069	.231
18.7	9.7	14.20	327	1.928	.209
25.5	13.7	19.60	451	1.861	.198
28.5	15.9	22.20	511	1.792	.186
32.5	18.3	25.40	585	1.776	.183
36.0	20.6	28.30	651	1.748	.178
40.0	23.4	31.70	730	1.709	.171
45.0	26.6	35.80	824	1.692	.167
50.0	30.0	40.00	921	1.667	.163
45.0	26.1	35.55	818	1.724	.173
40.0	22.8	31.40	723	1.754	.179
35.0	19.4	27.20	626	1.804	.188
30.0	16.3	23.15	533	1.840	.194
25.0	13.2	19.10	440	1.894	.203
20.0	10.0	15.00	345	2.000	.221
15.0	7.3	11.15	257	2.055	.229
10.0	4.9	7.45	172	2.041	.227
7.6	3.5	5.55	128	2.171	.247
20.7	11.0	15.85	365	1.882	.201

TEST NUMBER: 12

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
21.6	11.5	16.55	381	1.878	.201
25.6	13.7	19.65	452	1.869	.199
30.0	16.4	23.20	534	1.829	.192
35.4	19.2	27.30	628	1.844	.195
40.0	22.0	31.00	714	1.818	.190
45.0	23.5	34.25	788	1.915	.207
50.0	25.4	37.70	868	1.969	.216
45.0	22.1	33.55	772	2.036	.226
40.0	19.2	29.60	681	2.083	.234
35.0	16.2	25.60	589	2.160	.245
30.0	13.3	21.65	498	2.256	.259
25.0	10.7	17.85	411	2.336	.270
20.0	8.2	14.10	325	2.439	.284
15.0	6.1	10.55	243	2.459	.286
10.0	4.4	7.20	166	2.273	.261
9.2	4.0	6.60	152	2.300	.265
13.5	6.4	9.95	229	2.109	.238
19.1	9.5	14.30	329	2.011	.222
25.5	13.0	19.25	443	1.962	.214
30.0	14.6	22.30	513	2.055	.229
35.0	16.5	25.75	593	2.121	.239
40.0	19.0	29.50	679	2.105	.237
45.0	21.8	33.40	769	2.064	.231
50.0	25.5	37.75	869	1.961	.214
45.0	22.9	33.95	782	1.965	.215
40.0	19.9	29.95	689	2.010	.222
35.0	17.0	26.00	599	2.059	.230
30.0	14.2	22.10	509	2.113	.238
25.0	11.5	18.25	420	2.174	.247
20.0	8.8	14.40	331	2.273	.261
15.0	6.3	10.65	245	2.381	.276
10.0	4.5	7.25	167	2.222	.254
8.3	3.7	6.00	138	2.243	.257
30.0	15.2	22.60	520	1.974	.216
27.8	15.2	21.50	495	1.829	.192
25.8	15.2	20.50	472	1.697	.168

TEST NUMBER: 13

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
20.2	12.2	16.20	373	1.656	.161
19.1	12.0	15.55	358	1.592	.148
7.7	4.1	5.90	136	1.878	.201
10.0	5.8	7.90	182	1.724	.173
15.0	9.6	12.30	283	1.563	.142
20.0	13.1	16.55	381	1.527	.135
25.0	16.9	20.95	482	1.479	.125
30.0	20.6	25.30	582	1.456	.120
35.0	24.0	29.50	679	1.458	.120
40.0	28.3	34.15	786	1.413	.110
44.5	31.3	37.90	872	1.422	.112
16.8	10.5	13.65	314	1.600	.150
20.0	13.4	16.70	384	1.493	.127
25.0	16.8	20.90	481	1.488	.127
30.0	20.7	25.35	584	1.449	.118
35.0	24.7	29.85	687	1.417	.111
40.0	28.2	34.10	785	1.418	.111
45.0	32.2	38.60	889	1.398	.107
50.0	36.0	43.00	990	1.389	.105
55.0	40.5	47.75	1,099	1.358	.097
50.0	35.3	42.65	982	1.416	.111
45.0	30.7	37.85	871	1.466	.122
40.0	27.1	33.55	772	1.476	.124
35.0	23.3	29.15	671	1.502	.130
30.0	19.5	24.75	570	1.538	.137
25.0	15.7	20.35	468	1.592	.148
20.0	12.1	16.05	369	1.653	.160
15.0	9.0	12.00	276	1.667	.163
20.0	13.5	16.75	386	1.481	.125
25.0	17.0	21.00	483	1.471	.123
30.0	20.8	25.40	585	1.442	.117
35.0	24.8	29.90	688	1.411	.110
40.0	28.7	34.35	791	1.394	.106
45.0	33.0	39.00	898	1.364	.099
50.0	37.0	43.50	1,001	1.351	.096
55.0	41.0	48.00	1,105	1.341	.094
50.0	36.1	43.05	991	1.385	.104
45.0	31.5	38.25	881	1.429	.114
40.0	27.5	33.75	777	1.455	.119
35.0	23.7	29.35	676	1.477	.124
30.0	19.6	24.80	571	1.531	.135
25.0	16.0	20.50	472	1.563	.142
20.0	12.2	16.10	371	1.639	.157
15.0	9.0	12.00	276	1.667	.163
11.0	6.0	8.50	196	1.833	.193

TEST NUMBER: 14

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
23.9	14.0	18.95	436	1.707	.170
22.5	13.9	18.20	419	1.619	.153
7.5	3.7	5.60	129	2.027	.225
10.3	6.0	8.15	188	1.717	.172
15.0	9.2	12.10	279	1.630	.156
20.0	12.5	16.25	374	1.600	.150
25.0	15.9	20.45	471	1.572	.144
30.0	19.3	24.65	567	1.554	.140
35.0	22.7	28.85	664	1.542	.138
40.0	26.0	33.00	760	1.538	.137
45.6	30.5	38.05	876	1.495	.128
40.0	25.6	32.80	755	1.563	.142
35.0	22.1	28.55	657	1.584	.146
30.0	18.3	24.15	556	1.639	.157
25.0	14.9	19.95	459	1.678	.165
20.0	11.4	15.70	361	1.754	.179
22.0	12.8	17.40	401	1.719	.172
20.5	12.5	16.50	380	1.640	.157
10.3	5.7	8.00	184	1.807	.188
15.0	9.0	12.00	276	1.667	.163
20.0	12.5	16.25	374	1.600	.150
25.0	16.0	20.50	472	1.563	.142
30.0	19.4	24.70	569	1.546	.139
35.0	23.0	29.00	668	1.522	.134
40.0	26.6	33.30	767	1.504	.130
45.0	30.5	37.75	869	1.475	.124
50.0	34.4	42.20	971	1.453	.119
45.0	30.0	37.50	863	1.500	.129
40.0	26.0	33.00	760	1.538	.137
35.0	22.3	28.65	660	1.570	.143
30.0	18.5	24.25	558	1.622	.154
25.0	15.2	20.10	463	1.645	.158
20.0	11.6	15.80	364	1.724	.173
15.0	8.4	11.70	269	1.786	.185
10.9	6.8	8.85	204	1.603	.150

TEST NUMBER: 15

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.39 AND 23.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
12.7	8.8	10.75	357	1.443	.117
12.9	9.0	10.95	363	1.433	.115
5.0	3.1	4.05	134	1.613	.152
10.0	6.8	8.40	279	1.471	.123
15.0	10.6	12.80	425	1.415	.111
20.0	14.2	17.10	568	1.408	.109
25.0	18.1	21.55	715	1.381	.103
29.5	21.5	25.50	846	1.372	.101
25.0	17.4	21.20	704	1.437	.115
20.0	13.4	16.70	554	1.493	.127
15.0	9.6	12.30	408	1.563	.142
10.0	6.1	8.05	267	1.639	.157
10.0	6.5	8.25	274	1.538	.137
15.0	10.2	12.60	418	1.471	.123
19.5	13.5	16.50	548	1.444	.117
25.0	17.8	21.40	710	1.404	.108
30.1	21.9	26.00	863	1.374	.101
25.0	17.2	21.10	700	1.453	.119
20.0	13.8	16.90	561	1.449	.118
15.0	9.6	12.30	408	1.563	.142
10.2	6.3	8.25	274	1.619	.153
5.1	2.9	4.00	133	1.759	.180

TEST NUMBER: 16

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
3.5-U SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.34 AND 23.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
8.3	5.0	6.65	221	1.660	.161
10.0	6.4	8.20	272	1.563	.142
12.5	8.0	10.25	340	1.563	.142
15.0	9.7	12.35	410	1.546	.139
17.5	11.5	14.50	481	1.522	.134
20.0	13.2	16.60	551	1.515	.132
22.5	14.8	18.65	619	1.520	.133
25.0	16.7	20.85	692	1.497	.128
27.0	18.2	22.60	750	1.484	.126
25.0	16.4	20.70	687	1.524	.134
22.5	14.5	18.50	614	1.552	.140
20.0	12.5	16.25	539	1.600	.150
17.5	10.8	14.15	470	1.620	.154
15.0	9.1	12.05	400	1.648	.159
12.5	7.9	10.20	339	1.582	.146
10.0	6.0	8.00	266	1.667	.163
12.5	7.7	10.10	335	1.623	.154
15.0	9.6	12.30	408	1.563	.142
17.5	11.6	14.55	483	1.509	.131
20.0	13.5	16.75	556	1.481	.125
22.5	15.2	18.85	626	1.480	.125
24.4	16.4	20.40	677	1.488	.126
22.5	15.0	18.75	622	1.500	.129
20.0	12.8	16.40	544	1.563	.142
17.5	11.1	14.30	475	1.577	.145
15.0	9.2	12.10	402	1.630	.156
12.5	7.6	10.05	334	1.645	.158
10.0	6.0	8.00	266	1.667	.163
7.0	4.0	5.50	183	1.750	.178
4.9	2.7	3.80	126	1.815	.190

TEST NUMBER: 17

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
10.8	5.3	8.05	274	2.038	.227
15.0	7.5	11.25	382	2.000	.221
20.0	10.3	15.15	515	1.942	.211
25.0	13.2	19.10	649	1.894	.203
30.0	16.1	23.05	783	1.863	.198
33.6	18.9	26.25	892	1.778	.183
30.0	17.3	23.65	804	1.734	.175
25.0	14.0	19.50	663	1.786	.185
20.0	10.7	15.35	522	1.869	.199
15.0	7.3	11.15	379	2.055	.229
11.8	5.5	8.65	294	2.145	.243
15.0	7.3	11.15	379	2.055	.229
20.0	10.1	15.05	512	1.980	.217
25.0	13.1	19.05	647	1.908	.206
30.0	16.0	23.00	782	1.875	.200
33.0	17.8	25.40	863	1.854	.196
30.0	16.2	23.10	785	1.852	.196
25.0	12.5	18.75	637	2.000	.221
20.0	9.5	14.75	501	2.105	.237
15.0	7.1	11.05	376	2.113	.238
9.3	4.1	6.70	228	2.268	.261
5.0	2.2	3.60	122	2.273	.261

TEST NUMBER: 18

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V SMOOTH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
15.0	7.0	11.00	374	2.143	.243
17.5	8.7	13.10	445	2.011	.222
20.0	10.1	15.05	512	1.980	.217
22.5	11.8	17.15	583	1.907	.205
25.0	13.0	19.00	646	1.923	.208
27.5	15.1	21.30	724	1.821	.191
29.0	16.5	22.75	773	1.758	.180
27.5	14.8	21.15	719	1.858	.197
25.0	13.5	19.25	654	1.852	.196
22.5	12.0	17.25	586	1.875	.200
20.0	10.5	15.25	518	1.905	.205
17.5	8.9	13.20	449	1.966	.215
15.0	7.5	11.25	382	2.000	.221
12.5	6.1	9.30	316	2.049	.228
9.8	4.6	7.20	245	2.130	.241
7.2	3.3	5.25	178	2.182	.248
10.2	5.2	7.70	262	1.962	.214
12.5	6.8	9.65	328	1.838	.194
15.0	8.3	11.65	396	1.807	.188
17.5	10.0	13.75	467	1.750	.178
20.0	11.4	15.70	534	1.754	.179
22.5	13.1	17.80	605	1.718	.172
24.3	14.2	19.25	654	1.711	.171
22.5	12.6	17.55	596	1.786	.185
20.0	10.9	15.45	525	1.835	.193
17.5	9.3	13.40	455	1.882	.201
15.0	7.6	11.30	384	1.974	.216
9.4	4.5	6.95	236	2.089	.234
4.8	2.2	3.50	119	2.182	.248
2.5	1.1	1.80	61	2.273	.261

TEST NUMBER: 19

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
3.6	1.1	2.35	80	3.273	.377
5.1	1.6	3.35	114	3.188	.369
9.4	4.2	6.80	231	2.238	.256
13.2	6.0	9.60	326	2.200	.251
17.2	6.2	11.70	398	2.774	.325
20.0	7.0	13.50	459	2.857	.334
18.5	8.9	13.70	466	2.079	.233
20.0	10.2	15.10	513	1.961	.214
25.0	13.8	19.40	659	1.812	.189
30.2	17.5	23.85	811	1.726	.174
25.0	14.2	19.60	666	1.761	.180
20.0	11.0	15.50	527	1.818	.190
15.0	7.6	11.30	384	1.974	.216
11.0	5.7	8.35	284	1.930	.209
5.0	2.5	3.75	127	2.000	.221
5.0	2.4	3.70	126	2.083	.234
10.0	5.6	7.80	265	1.786	.185
15.0	6.9	10.95	372	2.174	.247
17.7	9.0	13.35	454	1.967	.215
20.0	11.0	15.50	527	1.818	.190
25.0	14.2	19.60	666	1.761	.180
29.7	17.0	23.35	794	1.747	.178
25.0	14.0	19.50	663	1.786	.185
20.0	10.7	15.35	522	1.869	.199
15.0	8.1	11.55	393	1.852	.196
10.5	5.6	8.05	274	1.875	.200
5.0	2.5	3.75	127	2.000	.221

TEST NUMBER: 20

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
2.5	1.0	1.75	59	2.500	.292
5.0	2.2	3.60	122	2.273	.261
7.5	2.6	5.05	172	2.885	.337
10.0	3.3	6.65	226	3.030	.353
12.5	5.0	8.75	297	2.500	.292
15.0	6.0	10.50	357	2.500	.292
17.5	6.5	12.00	408	2.692	.315
20.0	7.6	13.80	469	2.632	.308
22.5	9.0	15.75	535	2.500	.292
25.0	11.0	18.00	612	2.273	.261
27.5	12.7	20.10	683	2.165	.246
28.9	13.7	21.30	724	2.109	.238
27.5	12.9	20.20	687	2.132	.241
25.0	11.5	18.25	620	2.174	.247
22.5	10.0	16.25	552	2.250	.258
20.0	8.5	14.25	484	2.353	.272
17.5	7.0	12.25	416	2.500	.292
15.0	6.7	10.85	369	2.239	.257
9.6	3.5	6.55	223	2.743	.321
5.0	1.7	3.35	114	2.941	.343
5.0	2.0	3.50	119	2.500	.292
7.5	3.0	5.25	178	2.500	.292
10.0	4.2	7.10	241	2.381	.276
12.5	5.2	8.85	301	2.404	.279
15.0	6.1	10.55	359	2.459	.286
17.5	7.0	12.25	416	2.500	.292
20.0	8.1	14.05	478	2.469	.288
22.5	9.9	16.20	551	2.273	.261
25.0	11.5	18.25	620	2.174	.247
27.6	13.2	20.40	693	2.091	.235
25.0	11.9	18.45	627	2.101	.236
22.5	10.1	16.30	554	2.228	255
20.0	8.6	14.30	486	2.326	.269
17.5	7.2	12.35	420	2.431	.283
15.8	6.0	10.90	370	2.633	.308
9.5	3.5	6.50	221	2.714	.318
5.5	1.9	3.70	126	2.895	.338

TEST NUMBER: 21

2-IN-1 PLOYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	1.6	3.30	76	3.125	.363
10.0	3.2	6.60	152	3.125	.363
15.0	4.7	9.85	227	3.191	.369
18.8	6.5	12.65	291	2.892	.338
15.5	7.2	11.35	261	2.153	.244
20.0	10.0	15.00	345	2.000	.221
25.0	14.0	19.50	449	1.786	.185
30.0	17.5	23.75	547	1.714	.172
35.0	21.2	28.10	647	1.651	.160
40.0	24.5	32.25	742	1.633	.156
43.0	25.3	34.15	786	1.700	.169
5.0	2.8	3.90	90	1.786	.185
10.0	5.5	7.75	178	1.818	.190
12.5	7.0	9.75	224	1.786	.185
15.0	8.8	11.90	274	1.705	.170
20.0	12.0	16.00	368	1.667	.163
25.0	15.4	20.20	465	1.623	.154
30.0	18.8	24.40	562	1.596	.149
35.0	22.0	28.50	656	1.591	.148
40.0	25.7	32.85	756	1.556	.141
45.0	29.5	37.25	858	1.525	.134
50.0	32.1	41.05	945	1.558	.141
45.0	29.0	37.00	852	1.552	.140
40.0	25.1	32.55	749	1.594	.148
35.0	22.0	28.50	656	1.591	.148
30.0	18.5	24.25	558	1.622	.154
25.0	15.0	20.00	460	1.667	.163
20.0	12.0	16.00	368	1.667	.163
15.0	8.8	11.90	274	1.705	.170
10.0	6.0	8.00	184	1.667	.163
8.4	5.0	6.70	154	1.680	.165
10.0	6.5	8.25	190	1.538	.137
15.0	9.4	12.20	281	1.596	.149
20.0	12.7	16.35	376	1.575	.145
25.0	16.4	20.70	477	1.524	.134
29.5	19.2	24.35	561	1.536	.137
35.0	22.0	28.50	656	1.591	.148
40.0	25.6	32.80	755	1.563	.142
45.0	29.1	37.05	853	1.546	.139
50.0	33.0	41.50	955	1.515	.132
45.0	28.7	36.85	848	1.568	.143
40.0	25.1	32.55	749	1.594	.148
35.0	21.7	28.35	653	1.613	.152
30.0	17.9	23.95	551	1.676	.164
25.0	15.0	20.00	460	1.667	.163
20.0	12.0	16.00	368	1.667	.163
15.0	8.7	11.85	273	1.724	.173
10.0	6.0	8.00	184	1.667	.163
13.3	5.0	9.15	211	2.660	.311

TEST NUMBER: 22

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V ROUGH SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	2.7	3.85	89	1.852	.196
10.0	5.0	7.50	173	2.000	.221
15.0	6.0	10.50	242	2.500	.292
20.3	7.5	13.90	320	2.707	.317
17.5	8.2	12.85	296	2.134	.241
20.0	10.1	15.05	346	1.980	.217
25.0	13.2	19.10	440	1.894	.203
30.0	16.5	23.25	535	1.818	.190
35.0	20.0	27.50	633	1.750	.178
40.0	23.5	31.75	731	1.702	.169
45.0	26.1	35.55	818	1.724	.173
49.0	29.4	39.20	902	1.667	.163
45.0	26.8	35.90	826	1.679	.165
40.0	23.6	31.80	732	1.695	.168
35.0	20.2	27.60	635	1.733	.175
30.0	17.1	23.55	542	1.754	.179
25.0	14.0	19.50	449	1.786	.185
20.0	10.7	15.35	353	1.869	.199
15.0	8.0	11.50	265	1.875	.200
10.0	5.2	7.60	175	1.923	.208
9.5	4.8	7.15	165	1.979	.217
10.2	5.2	7.70	177	1.962	.214
15.3	8.0	11.65	268	1.913	.206
20.0	10.6	15.30	352	1.887	.202
25.0	13.6	19.30	444	1.838	.194
30.9	17.2	24.05	554	1.797	.186
34.8	20.0	27.40	631	1.740	.176
40.0	23.2	31.60	727	1.724	.173
44.5	26.5	35.50	817	1.679	.165
49.8	30.0	39.90	919	1.660	.161
45.0	27.0	36.00	829	1.667	.163
40.0	23.6	31.80	732	1.695	.168
35.0	20.0	27.50	633	1.750	.178
30.0	17.1	23.55	542	1.754	.179
25.0	14.0	19.50	449	1.786	.185
20.0	11.0	15.50	357	1.818	.190
15.0	7.9	11.45	264	1.899	.204
10.0	5.2	7.60	175	1.923	.208

TEST NUMBER: 23

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	2.0	3.50	81	2.500	.292
10.0	3.5	6.75	155	2.857	.334
17.4	6.5	11.95	275	2.677	.313
15.5	7.5	11.50	265	2.067	.231
20.0	9.7	14.85	342	2.062	.230
25.0	12.7	18.85	434	1.969	.216
30.0	16.0	23.00	529	1.875	.200
35.0	19.2	27.10	624	1.823	.191
40.0	22.5	31.25	719	1.778	.183
45.0	25.5	35.25	811	1.765	.181
49.5	27.7	38.60	889	1.787	.185
45.0	27.0	36.00	829	1.667	.163
40.0	24.0	32.00	737	1.667	.163
35.0	19.2	27.10	624	1.823	.191
30.0	15.9	22.95	528	1.887	.202
25.0	13.7	19.35	445	1.825	.191
20.0	10.7	15.35	353	1.869	.199
15.0	7.7	11.35	261	1.948	.212
10.0	5.0	7.50	173	2.000	.221
8.5	4.5	6.50	150	1.889	.202
10.0	5.0	7.50	173	2.000	.221
15.0	7.7	11.35	261	1.948	.212
20.0	10.8	15.40	355	1.852	.196
25.0	13.5	19.25	443	1.852	.196
30.0	16.3	23.15	533	1.840	.194
35.0	19.8	27.40	631	1.768	.181
40.0	23.3	31.65	729	1.717	.172
44.0	26.8	35.40	815	1.642	.158
50.0	30.0	40.00	921	1.667	.163
45.0	27.5	36.25	834	1.636	.157
40.0	23.3	31.65	729	1.717	.172
35.0	20.5	27.75	639	1.707	.170
30.0	17.0	23.50	541	1.765	.181
25.0	14.0	19.50	449	1.786	.185
20.0	11.1	15.55	358	1.802	.187
15.0	8.1	11.55	266	1.852	.196
10.0	5.4	7.70	177	1.852	.196
9.4	5.1	7.25	167	1.843	.195

TEST NUMBER: 24

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
15.0	6.0	10.50	242	2.500	.292
20.0	8.6	14.30	329	2.326	.269
25.0	10.9	17.95	413	2.294	.264
30.0	14.0	22.00	506	2.143	.243
35.0	17.5	26.25	604	2.000	.221
40.0	21.2	30.60	704	1.887	.202
45.0	22.5	33.75	777	2.000	.221
50.0	25.3	37.65	867	1.976	.217
45.0	23.7	34.35	791	1.899	.204
40.0	19.5	29.75	685	2.051	.229
35.0	16.6	25.80	594	2.108	.237
30.0	14.1	22.05	508	2.128	.240
25.0	10.9	17.95	413	2.294	.264
20.0	8.8	14.40	331	2.273	.261
15.0	6.3	10.65	245	2.381	.276
10.0	4.0	7.00	161	2.500	.292
7.5	3.1	5.30	122	2.419	.281
10.0	4.4	7.20	166	2.273	.261
15.0	6.5	10.75	247	2.308	.266
20.0	9.0	14.50	334	2.222	.254
25.0	11.5	18.25	420	2.174	.247
30.0	14.5	22.25	512	2.069	.231
35.0	17.5	26.25	604	2.000	.221
40.0	20.0	30.00	691	2.000	.221
45.0	22.5	33.75	777	2.000	.221
50.0	25.0	37.50	863	2.000	.221
45.0	22.3	33.65	775	2.018	.223
40.0	19.8	29.90	688	2.020	.224
35.0	17.0	26.00	599	2.059	.230
30.0	14.2	22.10	509	2.113	.238
25.0	12.0	18.50	426	2.083	.234
20.0	9.1	14.55	335	2.198	.251
15.0	6.6	10.80	249	2.273	.261
10.0	4.4	7.20	166	2.273	.261
7.7	3.3	5.50	127	2.333	.270

TEST NUMBER: 25

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.38 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
6.1	4.0	5.05	116	1.525	.134
10.0	6.2	8.10	186	1.613	.152
15.0	9.1	12.05	277	1.648	.159
20.0	12.0	16.00	368	1.667	.163
25.0	15.5	20.25	466	1.613	.152
30.0	18.6	24.30	559	1.613	.152
35.0	22.1	28.55	657	1.584	.146
40.0	25.8	32.90	757	1.550	.140
45.0	30.0	37.50	863	1.500	.129
50.0	34.7	42.35	975	1.441	.116
45.0	29.0	37.00	852	1.552	.140
40.0	25.3	32.65	752	1.581	.146
35.0	22.0	28.50	656	1.591	.148
30.0	18.0	24.00	552	1.667	.163
25.0	15.4	20.20	465	1.623	.154
20.0	12.0	16.00	368	1.667	.163
15.0	8.6	11.80	272	1.744	.177
10.0	6.0	8.00	184	1.667	.163
7.0	4.5	5.75	132	1.556	.141
14.5	9.0	11.75	270	1.611	.152
20.0	12.4	16.20	373	1.613	.152
25.0	15.9	20.45	471	1.572	.144
30.0	18.7	24.35	561	1.604	.150
35.0	23.0	29.00	668	1.522	.134
40.0	26.0	33.00	760	1.538	.137
45.0	30.5	37.75	869	1.475	.124
50.0	34.0	42.00	967	1.471	.123
45.0	29.2	37.10	854	1.541	.138
40.0	25.7	32.85	756	1.556	.141
35.0	22.0	28.50	656	1.591	.148
30.0	18.7	24.35	561	1.604	.150
25.0	15.3	20.15	464	1.634	.156
20.0	11.8	15.90	366	1.695	.168
15.0	8.7	11.85	273	1.724	.173
10.0	6.0	8.00	184	1.667	.163
7.5	4.9	6.20	143	1.531	.135

TEST NUMBER: 26

2-IN-1 POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
3.5-U KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 20.38 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.5	2.4	3.95	91	2.292	.264
10.0	4.5	7.25	167	2.222	.254
15.0	7.6	11.30	260	1.974	.216
20.0	10.5	15.25	351	1.905	.205
25.0	14.1	19.55	450	1.773	.182
30.0	17.3	23.65	544	1.734	.175
35.0	21.2	28.10	647	1.651	.160
40.0	24.5	32.25	742	1.633	.156
45.0	28.7	36.85	848	1.568	.143
50.0	33.0	41.50	955	1.515	.132
45.0	27.0	36.00	829	1.667	.163
40.0	24.0	32.00	737	1.667	.163
35.0	20.3	27.65	637	1.724	.173
30.0	17.0	23.50	541	1.765	.181
25.0	13.5	19.25	443	1.852	.196
20.0	10.0	15.00	345	2.000	.221
15.0	6.8	10.90	251	2.206	.252
9.4	4.1	6.75	155	2.293	.264
10.0	4.6	7.30	168	2.174	.247
15.0	7.7	11.35	261	1.948	.212
20.0	11.0	15.50	357	1.818	.190
25.0	14.5	19.75	455	1.724	.173
30.0	17.5	23.75	547	1.714	.172
35.0	21.6	28.30	651	1.620	.154
40.0	24.7	32.35	745	1.619	.153
45.0	28.5	36.75	846	1.579	.145
50.0	33.0	41.50	955	1.515	.132
45.0	27.2	36.10	831	1.654	.160
40.0	23.7	31.85	733	1.688	.167
35.0	20.1	27.55	634	1.741	.177
30.0	17.0	23.50	541	1.765	.181
25.0	13.5	19.25	443	1.852	.196
20.0	10.0	15.00	345	2.000	.221
15.0	7.1	11.05	254	2.113	.238
10.0	4.6	7.30	168	2.174	.247

TEST NUMBER: 27

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V ROUGH KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	2.5	3.75	127	2.000	.221
7.5	3.8	5.65	192	1.974	.216
10.0	4.8	7.40	252	2.083	.234
12.5	5.6	9.05	308	2.232	.256
15.0	6.4	10.70	364	2.344	.271
17.5	7.0	12.25	416	2.500	.292
20.0	8.0	14.00	476	2.500	.292
22.5	10.2	16.35	556	2.206	.252
25.0	12.4	18.70	636	2.016	.223
27.5	14.5	21.00	714	1.897	.204
25.0	12.3	18.65	634	2.033	.226
22.5	11.1	16.80	571	2.027	.225
20.0	9.9	14.95	508	2.020	.224
17.5	8.5	13.00	442	2.059	.230
15.0	6.9	10.95	372	2.174	.247
12.5	5.5	9.00	306	2.273	.261
10.5	4.6	7.55	257	2.283	.263
7.6	3.4	5.50	187	2.235	.256
4.1	1.7	2.90	99	2.412	.280
5.0	2.0	3.50	119	2.500	.292
7.5	3.0	5.25	178	2.500	.292
10.0	4.1	7.05	240	2.439	.284
12.5	5.0	8.75	297	2.500	.292
15.0	6.5	10.75	365	2.308	.266
17.5	8.1	12.80	435	2.160	.245
20.0	9.6	14.80	503	2.083	.234
22.5	11.0	16.75	569	2.045	.228
25.0	12.7	18.85	641	1.969	.216
27.5	14.0	20.75	705	1.964	.215
30.0	15.5	22.75	773	1.935	.210
27.5	14.5	21.00	714	1.897	.204
25.0	13.0	19.00	646	1.923	.208
22.5	11.6	17.05	579	1.940	.211
20.0	10.0	15.00	510	2.000	.221
17.5	8.5	13.00	442	2.059	.230
15.0	7.0	11.00	374	2.143	.243
12.5	5.9	9.20	313	2.119	.239

TEST NUMBER: 28

2-IN-1 NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V KF POLYMER SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	2.4	3.70	126	2.083	.234
7.5	3.8	5.65	192	1.974	.216
10.0	6.0	8.00	272	1.667	.163
12.5	7.2	9.85	335	1.736	.176
15.0	7.7	11.35	386	1.948	.212
17.5	8.6	13.05	444	2.035	.226
20.0	9.6	14.80	503	2.083	.234
22.5	10.5	16.50	561	2.143	.243
25.0	11.3	18.15	617	2.212	.253
27.5	13.0	20.25	688	2.115	.238
30.0	15.9	22.95	780	1.887	.202
32.5	17.7	25.10	853	1.836	.193
34.5	19.5	27.00	918	1.769	.182
32.5	18.7	25.60	870	1.738	.176
30.0	17.0	23.50	799	1.765	.181
27.5	15.5	21.50	731	1.774	.183
25.0	13.6	19.30	656	1.838	.194
22.5	11.8	17.15	583	1.907	.205
20.0	10.0	15.00	510	2.000	.221
17.5	8.2	12.85	437	2.134	.241
15.0	6.7	10.85	369	2.239	.257
12.5	5.5	9.00	306	2.273	.261
5.0	2.0	3.50	119	2.500	.292
7.5	3.1	5.30	180	2.419	.281
10.0	4.3	7.15	243	2.326	.269
12.5	5.6	9.05	308	2.232	.256
15.0	7.0	11.00	374	2.143	.243
17.5	8.0	12.75	433	2.188	.249
20.0	9.2	14.60	496	2.174	.247
22.5	10.7	16.60	564	2.103	.237
25.0	12.1	18.55	630	2.066	.231
27.5	14.0	20.75	705	1.964	.215
30.0	15.8	22.90	778	1.899	.204
33.0	18.1	25.55	868	1.823	.191
30.0	16.7	23.35	794	1.796	.186
27.5	15.4	21.45	729	1.786	.185
25.0	13.4	19.20	653	1.866	.199
22.5	11.6	17.05	579	1.940	.211
20.0	10.1	15.05	512	1.980	.217
17.5	8.6	13.05	444	2.035	.226
15.0	7.0	11.00	374	2.143	.243
12.6	5.5	9.05	308	2.291	.264

TEST NUMBER: 29

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
10.0	4.0	7.00	238	2.500	.292
12.5	5.7	9.10	309	2.193	.250
15.0	7.2	11.10	377	2.083	.234
17.5	8.7	13.10	445	2.011	.222
20.0	10.0	15.00	510	2.000	.221
22.5	11.5	17.00	578	1.957	.214
25.0	12.8	18.90	642	1.953	.213
27.5	14.3	20.90	710	1.923	.208
30.0	15.9	22.95	780	1.887	.202
33.2	17.3	25.25	858	1.919	.207
30.0	14.4	22.20	755	2.083	.234
27.5	13.5	20.50	697	2.037	.226
25.0	12.9	18.95	644	1.938	.211
22.5	11.5	17.00	578	1.957	.214
20.0	10.4	15.20	517	1.923	.208
17.5	8.9	13.20	449	1.966	.215
15.0	7.4	11.20	381	2.027	.225
12.5	5.9	9.20	313	2.119	.239
8.0	3.0	5.50	187	2.667	.312
7.5	3.0	5.25	178	2.500	.292
10.0	4.2	7.10	241	2.381	.276
12.5	5.7	9.10	309	2.193	.250
15.0	7.4	11.20	381	2.027	.225
17.5	8.9	13.20	449	1.966	.215
20.0	10.0	15.00	510	2.000	.221
22.5	12.0	17.25	586	1.875	.200
25.0	13.2	19.10	649	1.894	.203
27.5	14.0	20.75	705	1.964	.215
30.0	15.6	22.80	775	1.923	.208
33.0	18.0	25.50	867	1.833	.193
30.0	16.0	23.00	782	1.875	.200
27.5	15.3	21.40	727	1.797	.187
25.0	14.2	19.60	666	1.761	.180
22.5	12.6	17.55	596	1.786	.185
20.0	10.6	15.30	520	1.887	.202
17.5	9.2	13.35	454	1.902	.205
15.0	7.6	11.30	384	1.974	.216
12.7	6.1	9.40	319	2.082	.233
7.3	2.7	5.00	170	2.704	.317
5.0	1.5	3.25	110	3.333	.383

TEST NUMBER: 30

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 22.46 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	1.5	3.25	110	3.333	.383
7.5	2.8	5.15	175	2.679	.314
10.0	4.7	7.35	250	2.128	.240
12.5	6.0	9.25	314	2.083	.234
15.0	7.5	11.25	382	2.000	.221
17.5	9.1	13.30	452	1.923	.208
20.0	10.7	15.35	522	1.869	.199
22.5	12.5	17.50	595	1.800	.187
25.0	14.2	19.60	666	1.761	.180
27.5	16.0	21.75	739	1.719	.172
29.5	17.2	23.35	794	1.715	.172
27.5	15.5	21.50	731	1.774	.183
25.0	13.5	19.25	654	1.852	.196
22.5	12.0	17.25	586	1.875	.200
20.0	10.1	15.05	512	1.980	.217
17.5	8.7	13.10	445	2.011	.222
15.0	7.1	11.05	376	2.113	.238
12.5	5.6	9.05	308	2.232	.256
7.5	2.5	5.00	170	3.000	.350
7.6	2.7	5.15	175	2.815	.329
10.0	4.0	7.00	238	2.500	.292
12.5	5.6	9.05	308	2.232	.256
15.0	7.0	11.00	374	2.143	.243
17.5	8.6	13.05	444	2.035	.226
20.0	10.2	15.10	513	1.961	.214
22.5	12.0	17.25	586	1.875	.200
25.0	13.5	19.25	654	1.852	.196
29.0	15.0	22.00	748	1.933	.210
25.0	13.7	19.35	658	1.825	.191
22.5	12.1	17.30	588	1.860	.197
20.0	10.5	15.25	518	1.905	.205
17.5	9.0	13.25	450	1.944	.212
15.0	7.0	11.00	374	2.143	.243
8.0	2.9	5.45	185	2.759	.323

TEST NUMBER: 31

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
32.5	21.5	27.00	622	1.512	.132
36.5	24.5	30.50	702	1.490	.127
10.0	5.8	7.90	182	1.724	.173
15.0	9.0	12.00	276	1.667	.163
20.0	12.6	16.30	375	1.587	.147
25.0	16.0	20.50	472	1.563	.142
30.0	19.3	24.65	567	1.554	.140
35.0	23.2	29.10	670	1.509	.131
40.0	27.1	33.55	772	1.476	.124
46.5	33.0	39.75	915	1.409	.109
40.0	27.5	33.75	777	1.455	.119
35.0	23.9	29.45	678	1.464	.121
30.0	19.7	24.85	572	1.523	.134
25.0	16.0	20.50	472	1.563	.142
20.0	12.2	16.10	371	1.639	.157
15.0	8.9	11.95	275	1.685	.166
10.0	5.6	7.80	180	1.786	.185
5.5	2.9	4.20	97	1.897	.204

TEST NUMBER: 32

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V NYLON SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.44 AND 24.00 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
19.7	11.7	15.70	361	1.684	.166
19.0	11.7	15.35	353	1.624	.154
20.1	12.7	16.40	378	1.583	.146
25.0	16.0	20.50	472	1.563	.142
30.0	19.2	24.60	566	1.563	.142
35.0	22.0	28.50	656	1.591	.148
40.0	25.6	32.80	755	1.563	.142
45.0	29.2	37.10	854	1.541	.138
50.0	33.6	41.80	962	1.488	.127
45.0	29.0	37.00	852	1.552	.140
40.0	25.4	32.70	753	1.575	.145
35.0	22.0	28.50	656	1.591	.148
30.0	18.6	24.30	559	1.613	.152
25.0	15.4	20.20	465	1.623	.154
20.0	12.2	16.10	371	1.639	.157
15.0	9.0	12.00	276	1.667	.163
10.0	5.8	7.90	182	1.724	.173
10.7	6.5	8.60	198	1.646	.159
15.0	9.2	12.10	279	1.630	.156
20.0	12.9	16.45	379	1.550	.140
25.0	16.4	20.70	477	1.524	.134
30.0	20.0	25.00	576	1.500	.129
35.0	23.5	29.25	673	1.489	.127
40.0	27.0	33.50	771	1.481	.125
45.0	30.5	37.75	869	1.475	.124
50.0	35.0	42.50	978	1.429	.114
45.0	30.5	37.75	869	1.475	.124
40.0	26.7	33.35	768	1.498	.129
35.0	23.0	29.00	668	1.522	.134
30.0	19.8	24.90	573	1.515	.132
25.0	16.3	20.65	475	1.534	.136
20.0	12.9	16.45	379	1.550	.140
15.0	9.4	12.20	281	1.596	.149
10.0	6.0	8.00	184	1.667	.163

TEST NUMBER: 33

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V URETHANE SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.55 AND 24.11 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
5.0	0.5	2.75	63	10.000	.733
10.0	0.9	5.45	125	11.111	.766
15.0	1.6	8.30	190	9.375	.712
20.0	3.0	11.50	264	6.667	.604
24.6	6.1	15.35	352	4.033	.444
22.1	6.3	14.20	325	3.508	.399
25.0	8.3	16.65	382	3.012	.351
30.0	12.5	21.25	487	2.400	.279
35.0	17.0	26.00	596	2.059	.230
40.0	22.0	31.00	710	1.818	.190
45.0	25.5	35.25	808	1.765	.181
50.0	32.0	41.00	940	1.563	.142
45.0	26.5	35.75	819	1.698	.169
40.0	21.7	30.85	707	1.843	.195
35.0	17.5	26.25	602	2.000	.221
30.0	12.8	21.40	490	2.344	.271
25.0	8.8	16.90	387	2.841	.332
20.0	5.5	12.75	292	3.636	.411
18.0	4.5	11.25	258	4.000	.441
20.0	6.1	13.05	299	3.279	.378
30.0	12.1	21.05	482	2.479	.289
40.0	21.2	30.60	701	1.887	.202
50.0	31.5	40.75	934	1.587	.147
40.0	22.0	31.00	710	1.818	.190
30.0	13.0	21.50	493	2.308	.266
20.0	5.7	12.85	294	3.509	.400
17.0	4.2	10.60	243	4.048	.445
50.0	10.0	30.00	687	5.000	.512
40.0	16.5	28.25	647	2.424	.282
35.0	13.5	24.25	556	2.593	.303
31.0	11.9	21.45	492	2.605	.305

TEST NUMBER: 34

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
70-V URETHANE WITH WEAR GROOVES SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 18.55 AND 24.11 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
11.5	1.5	6.50	149	7.667	.648
15.0	2.0	8.50	195	7.500	.641
20.0	3.2	11.60	266	6.250	.583
25.0	5.5	15.25	349	4.545	.482
26.3	6.5	16.40	376	4.046	.445
25.0	6.6	15.80	362	3.788	.424
23.5	6.8	15.15	347	3.456	.395
25.0	8.0	16.50	378	3.125	.363
30.0	11.9	20.95	480	2.521	.294
35.0	16.0	25.50	584	2.188	.249
40.0	19.5	29.75	682	2.051	.229
45.0	22.8	33.90	777	1.974	.216
50.0	27.8	38.90	891	1.799	.187
45.0	22.4	33.70	772	2.009	.222
40.0	17.1	28.55	654	2.339	.271
35.0	14.5	24.75	567	2.414	.280
30.0	11.0	20.50	470	2.727	.319
25.0	8.3	16.65	382	3.012	.351
19.7	5.5	12.60	289	3.582	.406
5.0	0.5	2.75	63	10.000	.733
10.0	1.0	5.50	126	10.000	.733
15.0	2.0	8.50	195	7.500	.641
20.0	3.2	11.60	266	6.250	.583
25.0	5.0	15.00	344	5.000	.512
28.4	7.5	17.95	411	3.787	.424
25.2	7.5	16.35	375	3.360	.386
30.0	11.0	20.50	470	2.727	.319
35.0	14.3	24.65	565	2.448	.285
40.0	18.7	29.35	673	2.139	.242
45.0	22.6	33.80	775	1.991	.219
50.0	27.0	38.50	882	1.852	.196
45.0	22.1	33.55	769	2.036	.226
40.0	18.4	29.20	669	2.174	.247
35.0	14.4	24.70	566	2.431	.283
30.0	10.9	20.45	469	2.752	.322
25.0	7.9	16.45	377	3.165	.367
21.6	5.7	13.65	313	3.789	.424

TEST NUMBER: 35

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 16.30 AND 23.23 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
28.3	12.9	20.60	490	2.194	.250
27.5	12.9	20.20	480	2.132	.241
15.0	6.5	10.75	256	2.308	.266
20.0	9.2	14.60	347	2.174	.247
25.0	12.0	18.50	440	2.083	.234
30.0	15.0	22.50	535	2.000	.221
35.0	17.9	26.45	629	1.955	.213
40.0	20.7	30.35	722	1.932	.210
44.1	23.1	33.60	799	1.909	.206
40.0	21.0	30.50	725	1.905	.205
35.0	17.1	26.05	620	2.047	.228
30.0	14.2	22.10	526	2.113	.238
25.0	11.4	18.20	433	2.193	.250
5.0	2.5	3.75	89	2.000	.221
10.0	4.6	7.30	174	2.174	.247
15.0	6.9	10.95	260	2.174	.247
20.0	9.2	14.60	347	2.174	.247
25.0	11.7	18.35	436	2.137	.242
30.0	14.5	22.25	529	2.069	.231
35.0	17.4	26.20	623	2.011	.222
40.0	20.4	30.20	718	1.961	.214
45.0	23.7	34.35	817	1.899	.204
50.0	27.9	38.95	926	1.792	.186
45.0	22.4	33.70	801	2.009	.222
40.0	19.0	29.50	702	2.105	.237
35.0	16.1	25.55	608	2.174	.247
30.0	13.1	21.55	513	2.290	.264
25.0	10.5	17.75	422	2.381	.276
20.0	8.0	14.00	333	2.500	.292
15.0	5.8	10.40	247	2.586	.302
10.4	3.7	7.05	168	2.811	.329
9.8	3.7	6.75	161	2.649	.310
15.0	6.5	10.75	256	2.308	.266
20.0	9.0	14.50	345	2.222	.254
25.0	11.4	18.20	433	2.193	.250
30.0	14.1	22.05	524	2.128	.240
35.0	17.1	26.05	620	2.047	.228
40.0	20.0	30.00	713	2.000	.221
45.0	22.9	33.95	807	1.965	.215
50.0	26.6	38.30	911	1.880	.201
45.0	21.8	33.40	794	2.064	.231
40.0	18.5	29.25	696	2.162	.245
35.0	15.7	25.35	603	2.229	.255
30.0	13.0	21.50	511	2.308	.266
25.0	10.5	17.75	422	2.381	.276
20.0	8.2	14.10	335	2.439	.284
15.0	6.0	10.50	250	2.500	.292

TEST NUMBER: 36

POLYESTER ROPE WITH DIAMETER OF 3.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 16.30 AND 23.23 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
29.5	12.8	21.15	503	2.305	.266
28.5	12.5	20.50	488	2.280	.262
12.1	4.5	8.30	197	2.689	.315
15.0	6.2	10.60	252	2.419	.281
20.0	8.5	14.25	339	2.353	.272
25.0	11.0	18.00	428	2.273	.261
30.0	13.6	21.80	518	2.206	.252
35.0	16.0	25.50	606	2.188	.249
40.0	19.0	29.50	702	2.105	.237
45.0	21.9	33.45	796	2.055	.229
49.8	25.0	37.40	889	1.992	.219
45.0	21.2	33.10	787	2.123	.240
40.0	18.0	29.00	690	2.222	.254
35.0	15.2	25.10	597	2.303	.265
30.0	12.5	21.25	505	2.400	.279
25.0	10.0	17.50	416	2.500	.292
20.0	7.7	13.85	329	2.597	.304
15.0	5.5	10.25	244	2.727	.319
10.0	3.5	6.75	161	2.857	.334
9.5	3.3	6.40	152	2.879	.337
15.0	6.2	10.60	252	2.419	.281
20.0	8.5	14.25	339	2.353	.272
25.0	11.0	18.00	428	2.273	.261
30.0	13.6	21.80	518	2.206	.252
35.0	16.0	25.50	606	2.188	.249
40.0	19.0	29.50	702	2.105	.237
45.0	21.7	33.35	793	2.074	.232
50.0	26.0	38.00	904	1.923	.208
45.0	21.4	33.20	790	2.103	.237
40.0	18.5	29.25	696	2.162	.245
35.0	15.5	25.25	601	2.258	.259
30.0	12.8	21.40	509	2.344	.271
25.0	10.4	17.70	421	2.404	.279
20.0	7.9	13.95	332	2.532	.296
15.0	5.6	10.30	245	2.679	.314
10.7	3.9	7.30	174	2.744	.321

TEST NUMBER: 37

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 16.30 AND 20.87 INCHES
TEST WAS RUN WITH ROPE DRY

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
19.5	8.7	14.10	516	2.241	.257
18.5	8.7	13.60	497	2.126	.240
20.0	9.7	14.85	543	2.062	.230
22.5	11.1	16.80	614	2.027	.225
25.0	12.5	18.75	686	2.000	.221
27.5	14.0	20.75	759	1.964	.215
30.0	15.6	22.80	834	1.923	.208
27.5	13.7	20.60	753	2.007	.222
25.0	12.1	18.55	679	2.066	.231
27.5	14.2	20.85	763	1.937	.210
30.0	15.9	22.95	839	1.887	.202
33.0	17.8	25.40	929	1.854	.196
30.0	16.4	23.20	849	1.829	.192
27.5	14.0	20.75	759	1.964	.215
25.0	12.4	18.70	684	2.016	.223
22.5	10.9	16.70	611	2.064	.231
20.0	9.5	14.75	540	2.105	.237
17.5	8.0	12.75	466	2.188	.249
16.0	7.2	11.60	424	2.222	.254
10.0	4.0	7.00	256	2.500	.292
12.5	5.8	9.15	335	2.155	.244
15.0	7.2	11.10	406	2.083	.234
17.5	8.5	13.00	475	2.059	.230
20.0	10.0	15.00	549	2.000	.221
22.5	11.4	16.95	620	1.974	.216
25.0	13.0	19.00	695	1.923	.208
28.3	15.5	21.90	801	1.826	.192
25.0	12.8	18.90	691	1.953	.213
22.5	11.2	16.85	616	2.009	.222
20.0	9.8	14.90	545	2.041	.227
17.5	8.4	12.95	474	2.083	.234
15.0	7.0	11.00	402	2.143	.243
12.5	5.6	9.05	331	2.232	.256
10.2	4.5	7.35	269	2.267	.260

TEST NUMBER: 38

NYLON ROPE WITH DIAMETER OF 2.62 INCHES
50-V SMOOTH STEEL SHEAVE SHAPE
SHEAVE ROOT AND PITCH DIAMETERS ARE 16.30 AND 20.87 INCHES
TEST WAS RUN WITH ROPE WET

HIGH LOAD KIPS	LOW LOAD KIPS	AVERAGE LOAD KIPS	ROPE PRESSURE PSI	RATIO	COEFFICIENT OF FRICTION
21.5	9.0	15.25	558	2.389	.277
21.0	8.9	14.95	547	2.360	.273
17.5	6.7	12.10	443	2.612	.306
20.0	8.2	14.10	516	2.439	.284
22.5	9.5	16.00	585	2.368	.274
25.0	10.8	17.90	655	2.315	.267
27.5	12.2	19.85	726	2.254	.259
30.0	13.8	21.90	801	2.174	.247
32.5	15.4	23.95	876	2.110	.238
36.1	17.5	26.80	980	2.063	.230
32.5	15.0	23.75	869	2.167	.246
30.0	13.5	21.75	796	2.222	.254
27.5	11.9	19.70	721	2.311	.267
25.0	10.3	17.65	646	2.427	.282
22.5	8.8	15.65	572	2.557	.299
20.0	7.4	13.70	501	2.703	.316
17.5	6.1	11.80	432	2.869	.335
15.0	5.0	10.00	366	3.000	.350
15.0	5.0	10.00	366	3.000	.350
17.5	6.4	11.95	437	2.734	.320
20.0	7.5	13.75	503	2.667	.312
22.5	8.9	15.70	574	2.528	.295
25.0	10.1	17.55	642	2.475	.288
27.5	11.7	19.60	717	2.350	.272
30.0	13.5	21.75	796	2.222	.254
32.5	15.3	23.85	872	2.138	.242
36.0	17.7	26.85	982	2.034	.226
32.5	15.1	23.80	871	2.152	.244
30.0	13.4	21.70	794	2.239	.25?
27.5	11.8	19.65	719	2.331	.269
25.0	10.1	17.55	642	2.475	.288
22.5	8.6	15.55	569	2.616	.306
20.0	7.4	13.70	501	2.703	.316
17.5	6.0	11.75	430	2.917	.341
15.4	5.0	10.20	373	3.080	.358

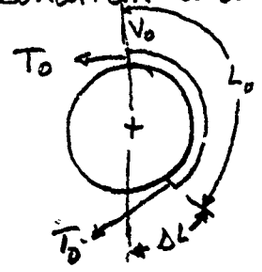
APPENDIX D

CALCULATIONS OF ESTIMATED BACK TENSION AND RELATIVE VELOCITY

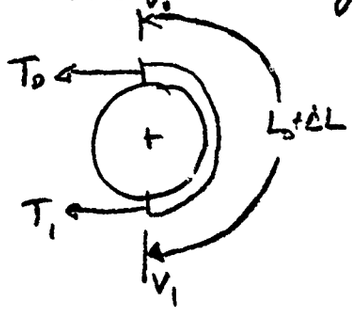
APPENDIX D

Calculations of Estimated Back Tension and Relative Velocity

Condition around one sheave before loading



after loading



$$V_1 = V_0 + \frac{\Delta L}{t}$$

$$V_0 = \frac{L_0}{t}$$

$$V_1 = V_0 + \frac{L_0}{t}\left(\frac{\Delta L}{L_0}\right) = V_0\left(1 + \frac{\Delta L}{L_0}\right)$$

$$\Delta L = \frac{T_1 - T_0}{EA} L_0$$

$$\frac{T_1}{T_0} = e^{\mu\pi} \qquad T_1 = T_0 e^{\mu\pi}$$

$$\frac{\Delta L}{L_0} = \frac{T_0(e^{\mu\pi} - 1)}{EA}$$

$$\therefore V_1 = V_0\left(1 + \frac{T_0(e^{\mu\pi} - 1)}{EA}\right)$$

The following program considers the changes in E and μ over each sheave. E is taken from typical manufacturer's data and μ is taken from part #35.

```
10 REM*****************************************************************
20 REM*****     PROGRAM NETVEL FOR DETERMINING THE RELATIVE      *****
30 REM*****     VELOCITY OF ROPE TO SHEAVE SURFACE               *****
40 REM*****     WRITTEN BY CARL S. ALBRO   9-MAY-83              *****
41 REM*****************************************************************
43 OPEN "SHVBNT.DAT" FOR OUTPUT AS FILE #2
45 GO TO 10000
49 REM***   SUBROUTINE FOR CALCULATING NET VELOCITY   ***************
50 W=W0*PI/30
60 K=EXP(M0*PI)-1
61 ON R0 GO TO 62,64,66,68
62 C1=.736 \ C2=-3.017 \ C3=4.814
63 K0=2.293 \ K1=-101.12 \ K2=2871.72 \ GO TO 70
64 C1=.93 \ C2=-3.621 \ C3=4.827
65 K0=3.94 \ K1=-232.38 \ K2=3811.23 \ GO TO 70
66 C1=1.319 \ C2=-5.58 \ C3=8.437
67 K0=1.421 \ K1=-48.4 \ K2=726.27 \ GO TO 70
68 C1=1.546 \ C2=-6.598 \ C3=10.496
69 K0=.641 \ K1=-9.12 \ K2=237.57
70 V(0)=W*D1/2
75 IF F9=1 THEN  GOSUB 3000
80 PRINT #1 \ PRINT #1,TAB(10)"BACK TENSION     PULLING TENSION     N
   ET VELOCITY"
90 PRINT #1,"              POUNDS             POUNDS               IN/SEC
   "
95 PRINT #1
96 P8=5000/B9 \ P9=100000/B9 \ P7=(P9-P8)/19
100 FOR P=P8 TO P9+7.00000E-03 STEP P7
105 T(N)=P*B9
110 FOR I=N TO 1 STEP -1
115 F=T(I)*C3(J)/(D1*1000) \ M0(I)=C1(J)*EXP(C2(J)*F)
120 T(I-1)=T(I)/EXP(PI*M0(I))
122 NEXT I
123 FOR I=1 TO N
124 P0=(T(I)+T(I-1))/(2*B9)
130 GOSUB 1000
140 V(I)=V(I-1)*(1+(EXP(M0(I)*PI)-1)*T(I-1)/E)
150 NEXT I
155 V9=V(N)-V(0)
160 PRINT #1,TAB(10);
170 PRINT #1,USING "  ######              ###.###              #.###",T(
   0),T(N),V9
175 PRINT #2,USING "###.###   ,    ########",T(0),T(N)
180 NEXT P
990 CLOSE #1 \ RETURN
999 REM***   SUBROUTINE FOR CALCULATING EA VALUE   ****************
   *******
1000 L0=C1*P0+C2*P0*P0+C3*P0*P0*P0
1100 E=B9*(K0+K1*L0+K2*L0*L0)
1110 RETURN
1999 REM***   SUBROUTINE FOR PRINTING CONTANTS   ******************
   *******
2000 OPEN "LP:" FOR OUTPUT AS FILE #1
2010 PRINT #1 \ PRINT #1 \ PRINT #1,TAB(10);DAT$ \ PRINT #1
2015 PRINT #1,USING "          ROPE TYPE IS 'E';R$(R)
2020 PRINT #1,USING "          ROPE DIAMETER IS #.# INCHES",DO
```

```
2030 PRINT #1,USING "          ROPE BREAKING STRENGTH IS ###,### POUN
     DS",B9
2040 PRINT #1,USING "          SHEAVE GROOVE PROFILE IS 'E",S$(J)
2050 PRINT #1,USING "          SHEAVE TREAD DIAMETER IS ##.## INCHES"
     ,D1
2060 PRINT #1,USING "          SHEAVE ROTATION RATE IS ##.# RPM",W0
2070 PRINT #1,USING "          NUMBER OF SHEAVES IS ##",N
2080 L=PI*D1*W0/12
2090 PRINT #1,USING "          THE LINE VELOCITY IS ###.# FEET PER MI
     NUTE",L
2100 RETURN
3000 P0=21200
3010 GOSUB 1000
3020 IF R0=1 THEN E0=E
3030 PRINT #1 \ PRINT #1,"          STIFFNESS RATIO IS";E/E0
3040 RETURN
9997 REM
9998 REM***   MAIN PART OF PROGRAM   ********************************
     *********
9999 REM
10000 N=5 \ D1=18 \ W0=5.57 \ M0=.2
10001 R$(1)="2-IN-1 POLYESTER-POLYESTER"
10002 R$(2)="12 STRAND POLYESTER-POLYPROPYLENE"
10003 R$(3)="2-IN-1 NYLON-POLYPROPYLENE"
10004 R$(4)="2-IN-1 NYLON-NYLON"
10010 FOR I=1 TO 3 \ READ S$(I) \ NEXT I
10020 FOR I=1 TO 3 \ READ C1(I),C2(I),C3(I) \ NEXT I
10070 R0=1 \ D0=3.62 \ B9=336000
10080 FOR J=1 TO 3
10085 FOR J1=1 TO 4 \ READ N,D1,W0
10087 PRINT #2,S$(J);N;"SHEAVES";D1;"TREAD DIAMETER"
10088 PRINT #2,20
10090 GOSUB 2000 \ GOSUB 50
10095 NEXT J1
10100 NEXT J
10200 CLOSE  \ STOP
30000 DATA "3.5-U","70-V","50-V"
30010 DATA .1887,-.01257,20.44,.2554,-.009055,18.39,.3042,-.007802,16
     .3
30020 DATA 8,10.44,12.8,8,20.44,6.54,10,20.44,6.54,10,32.44,4.12
30030 DATA 8,9.38,14.25,8,18.38,7.27,10,18.38,7.27,10,30.38,4.4
30040 DATA 8,9.38,14.25,8,17.07,7.83,10,17.07,7.83,10,29.07,4.6
32000 END
```

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 33[illegible],000 POUNDS
SHEAVE GROOVE PROFILE IS 3.5-U
SHEAVE TREAD DIAMETER IS 10.44 INCHES
SHEAVE ROTATION RATE IS 12.8 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
51	5000	0.056
122	10000	0.129
219	15000	0.199
351	20000	0.254
533	25000	0.295
784	30000	0.326
1132	35000	0.350
1615	40000	0.368
2287	45000	0.380
3222	50000	0.388
4519	55000	0.387
6302	60000	0.377
8714	65000	0.355
11902	70000	0.320
15993	75000	0.277
21053	80000	0.235
27071	85000	0.200
33946	90000	0.170
41514	95000	0.146
49577	100000	0.125

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 3.5-U
SHEAVE TREAD DIAMETER IS 20.44 INCHES
SHEAVE ROTATION RATE IS 6.5 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
47	5000	0.056
103	10000	0.129
169	15000	0.199
246	20000	0.255
336	25000	0.296
442	30000	0.329
567	35000	0.355
714	40000	0.376
886	45000	0.395
1090	50000	0.411
1329	55000	0.425
1612	60000	0.438
1945	65000	0.449
2339	70000	0.458
2806	75000	0.466
3358	80000	0.471
4012	85000	0.475
4786	90000	0.475
5703	95000	0.472
6788	100000	0.465

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 3.5-U
SHEAVE TREAD DIAMETER IS 20.44 INCHES
SHEAVE ROTATION RATE IS 6.5 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
14	5000	0.057
32	10000	0.130
52	15000	0.201
75	20000	0.256
103	25000	0.299
136	30000	0.332
174	35000	0.358
220	40000	0.381
274	45000	0.401
337	50000	0.419
412	55000	0.435
502	60000	0.450
608	65000	0.463
734	70000	0.476
885	75000	0.488
1066	80000	0.498
1283	85000	0.508
1545	90000	0.516
1860	95000	0.523
2240	100000	0.529

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 3.5-U
SHEAVE TREAD DIAMETER IS 32.44 INCHES
SHEAVE ROTATION RATE IS 4.1 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
14	5000	0.057
30	10000	0.130
47	15000	0.201
66	20000	0.256
87	25000	0.298
111	30000	0.331
137	35000	0.358
166	40000	0.381
198	45000	0.401
233	50000	0.419
272	55000	0.435
316	60000	0.450
364	65000	0.464
418	70000	0.478
478	75000	0.490
544	80000	0.502
618	85000	0.514
700	90000	0.524
792	95000	0.534
894	100000	0.542

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 70-V
SHEAVE TREAD DIAMETER IS 9.38 INCHES
SHEAVE ROTATION RATE IS 14.3 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
9	5000	0.057
21	10000	0.130
36	15000	0.201
56	20000	0.257
81	25000	0.299
113	30000	0.332
153	35000	0.358
205	40000	0.381
273	45000	0.401
360	50000	0.418
473	55000	0.434
620	60000	0.448
814	65000	0.461
1069	70000	0.472
1407	75000	0.482
1857	80000	0.489
2458	85000	0.494
3263	90000	0.495
4338	95000	0.492
5772	100000	0.481

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 70-V
SHEAVE TREAD DIAMETER IS 18.38 INCHES
SHEAVE ROTATION RATE IS 7.3 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
9	5000	0.057
19	10000	0.130
30	15000	0.202
43	20000	0.257
57	25000	0.298
74	30000	0.331
92	35000	0.357
113	40000	0.380
137	45000	0.399
164	50000	0.417
195	55000	0.434
229	60000	0.449
269	65000	0.463
314	70000	0.476
364	75000	0.489
422	80000	0.501
488	85000	0.513
563	90000	0.523
648	95000	0.533
746	100000	0.541

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 70-V
SHEAVE TREAD DIAMETER IS 18.38 INCHES
SHEAVE ROTATION RATE IS 7.3 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
2	5000	0.057
4	10000	0.131
6	15000	0.202
9	20000	0.257
11	25000	0.299
15	30000	0.331
19	35000	0.358
23	40000	0.380
28	45000	0.400
33	50000	0.419
39	55000	0.435
46	60000	0.450
54	65000	0.465
63	70000	0.479
73	75000	0.492
85	80000	0.505
99	85000	0.516
114	90000	0.528
131	95000	0.538
151	100000	0.548

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 70 V
SHEAVE TREAD DIAMETER IS 30.38 INCHES
SHEAVE ROTATION RATE IS 4.4 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
2	5000	0.057
4	10000	0.131
6	15000	0.202
8	20000	0.258
10	25000	0.299
13	30000	0.331
15	35000	0.357
18	40000	0.379
21	45000	0.399
25	50000	0.417
28	55000	0.433
32	60000	0.449
37	65000	0.463
41	70000	0.477
46	75000	0.490
52	80000	0.502
57	85000	0.514
64	90000	0.526
70	95000	0.537
78	100000	0.546

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 50-U
SHEAVE TREAD DIAMETER IS 9.38 INCHES
SHEAVE ROTATION RATE IS 14.3 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
3	5000	0.057
6	10000	0.131
10	15000	0.203
15	20000	0.258
21	25000	0.299
28	30000	0.332
36	35000	0.358
47	40000	0.381
60	45000	0.401
75	50000	0.419
94	55000	0.435
118	60000	0.450
146	65000	0.465
181	70000	0.479
225	75000	0.492
278	80000	0.504
345	85000	0.515
428	90000	0.525
532	95000	0.535
663	100000	0.543

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 50-V
SHEAVE TREAD DIAMETER IS 17.07 INCHES
SHEAVE ROTATION RATE IS 7.8 RPM
NUMBER OF SHEAVES IS 8
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
3	3000	0.057
5	10000	0.131
9	15000	0.203
12	20000	0.258
16	25000	0.298
20	30000	0.330
25	35000	0.356
31	40000	0.379
37	45000	0.398
44	50000	0.415
51	55000	0.432
60	60000	0.447
69	65000	0.462
79	70000	0.476
91	75000	0.489
103	80000	0.501
118	85000	0.513
134	90000	0.524
151	95000	0.534
171	100000	0.544

11-NOV-83

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 336,000 POUNDS
SHEAVE GROOVE PROFILE IS 50-V
SHEAVE TREAD DIAMETER IS 17.07 INCHES
SHEAVE ROTATION RATE IS 7.8 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
0	5000	0.057
1	10000	0.131
1	15000	0.203
2	20000	0.258
2	25000	0.298
3	30000	0.330
4	35000	0.357
5	40000	0.379
5	45000	0.398
6	50000	0.416
8	55000	0.432
9	60000	0.448
10	65000	0.463
12	70000	0.476
13	75000	0.489
15	80000	0.502
17	85000	0.514
20	90000	0.525
22	95000	0.536
25	100000	0.546

11-NOV-03

ROPE TYPE IS 2-IN-1 POLYESTER-POLYESTER
ROPE DIAMETER IS 3.6 INCHES
ROPE BREAKING STRENGTH IS 3[illegible],000 POUNDS
SHEAVE GROOVE PROFILE IS 50-V
SHEAVE TREAD DIAMETER IS 29.07 INCHES
SHEAVE ROTATION RATE IS 4.6 RPM
NUMBER OF SHEAVES IS 10
THE LINE VELOCITY IS 35.0 FEET PER MINUTE

BACK TENSION POUNDS	PULLING TENSION POUNDS	NET VELOCITY IN/SEC
0	5000	0.057
1	10000	0.131
1	15000	0.204
2	20000	0.259
2	25000	0.298
3	30000	0.329
3	35000	0.355
4	40000	0.377
4	45000	0.397
5	50000	0.414
6	55000	0.429
6	60000	0.444
7	65000	0.459
8	70000	0.473
9	75000	0.486
10	80000	0.499
11	85000	0.511
12	90000	0.523
13	95000	0.533
14	100000	0.543